University of Alberta

Wildfire Risk Management by Municipal Governments in Alberta, Canada

by

Lauren M. Harris ©

A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Master of Arts

Department of Earth and Atmospheric Sciences

Edmonton, Alberta
Spring 2008

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Your file Votre référence
ISBN: 978-0-494-45733-7
Our file Notre référence
ISBN: 978-0-494-45733-7

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Abstract

Little research has been completed on the implementation of wildfire risk management measures by local governments. This study aims to identify what wildfire measures 18 Alberta municipal governments are implementing, the most frequently used measures, how the measures were implemented, factors influencing the implementation process and how these affected this process.

This study used a two-phase method. Phase one included a written survey and semi-structured telephone interviews with 38 municipal government participants. Phase two included in-person interviews with 16 individuals in two municipalities from phase one.

All 18 had completed emergency preparedness plans, most completed infrastructure measures and/or communication, more than half completed wildfire hazard assessments and/or vegetation management, while less than half completed land-use planning and/or structural measures on government buildings. A six-stage process was completed to implement wildfire risk management measures. Wildfire experience, perceptions of wildfire risk, communication, support, resources, and geography influenced the municipal wildfire implementation process.

KEYWORDS: Wildfires, Municipalities, Municipal Government, Wildfire Risk Management Measures, Alberta Canada.

Dedication

This is dedicated to the participants in this study who are committed to protecting their municipality from a wildfire.

Acknowledgements

The completion of this thesis would not have been possible without the help and support from a number of individuals. My sincerest thanks to:

The Municipal Participants: For without their cooperation and interest in this study, it would not have been possible to complete.

Anastasia Drummond, Leslie-Anne Chapman, John McLevin, Adam Gossell, Pete Bothwell and the Alberta Sustainable Resource Development Wildfire Prevention Officers for their support, encouragement and the information they graciously provided.

Jolie Whetzel: for her help and discussions as this project unfolded.

Dr. Bonita McFarlane (committee member): for being part of my thesis committee, the stimulating discussion and directions towards making this project a reality.

Dr. Tara McGee (supervisor): I am very fortunate to have had the opportunity to work with Tara. Her extensive knowledge and expertise has assisted me in reaching my potential. This support and education will never be forgotten.

Finally, I would like to thank my parents for their extensive support and feedback throughout my Masters, and for their encouragement as I follow my dreams. My mother's sense of humor and discussions with my father helped me reach this point.

This study was funded in part by: Canadian Forest Service, Alberta Sustainable Resource Development, ATCO electric, Canadian Interagency Forest Fire Center (CIFFC), and the Institute for Catastrophic Loss Reduction (ICLR).

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CHAPTER ONE

Introduction

1.1 The Problem of Wildfires in Canada

Wildfires (forest fires, grass fires and brush fires) occur extensively throughout the world. Canada, the United States, Europe, and Australia are just a few countries that have experienced negative impacts of wildfires. Wildfires have both human causes (e.g. unattended camp fires, cigarettes, recreational vehicles, and industry), and natural causes (lightening, sparks from falling rocks and volcanic activity) (Gill 2005, Willis 2005, U.S. Fire Administration 2001). On a yearly basis in Canada, the average number of wildfires since 1980 has been 8,600, burning an average of approximately 2.5 million hectares of forest and wooded land annually (Taylor *et al.* 2006). In 2003, Canada's most devastating wildfire year, British Columbia experienced approximately 2,500 wildfires, destroying 334 homes and businesses, displacing 45,000 individuals, and costing approximately $700 million (Filmon 2004). In 2001, the Chisholm wildfire burnt approximately 116,000 hectares of land in Alberta, destroyed 10 homes, a trapper cabin, 48 outbuildings and some vehicles, mainly in the Hamlet of Chisholm costing $10 million in direct firefighting costs (Peter *et al.* 2006a, Chisholm Fire Review Committee 2001). The Chisholm wildfire was well documented, however Alberta has also experienced other large wildfires that have threatened municipalities. Two such wildfires are the Lost Creek wildfire in 2003 burning approximately 21,000 hectares of land, and the Virginia Hills wildfire in 1998, which burned approximately 154,094 hectares of land (Alberta Sustainable Resource Development 2006a). In general over the last 75 years, Alberta has experienced extensive wildfires, especially in the Forest Protection Zone (Figure 1.1). The majority of wildfires have occurred in northern Alberta, as may of these wildfires are left to burn out themselves because they do not occur near populated areas, however some of these wildfires have burned near towns. Central Alberta

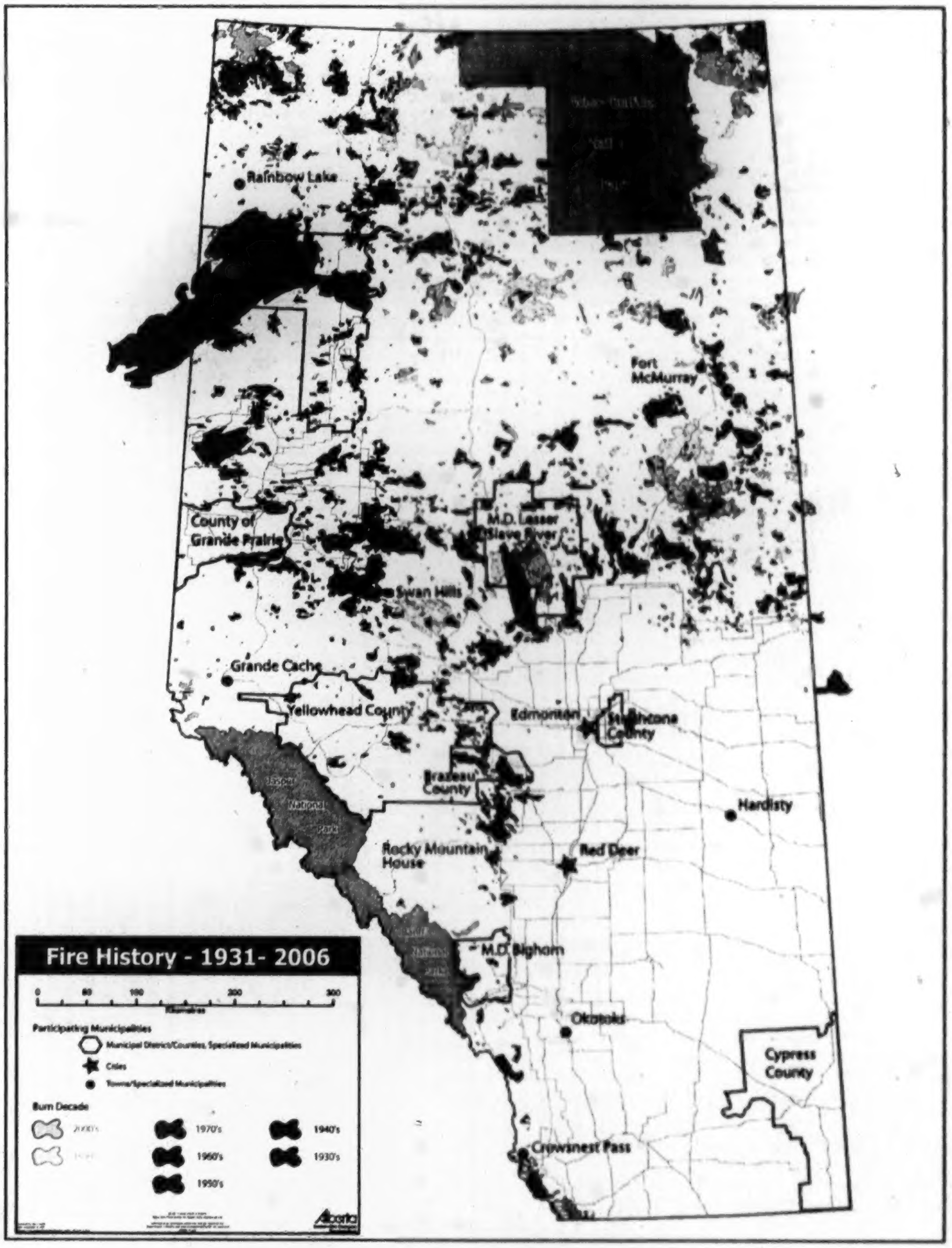

Rainbow Lake
Fort McMurray
County of Grande Prairie
M.D. Lesser Slave River
Swan Hills
Grande Cache
Yellowhead County
Edmonton
Strathcona County
Brazeau County
Hardisty
Rocky Mountain House
Red Deer
M.D. Bighorn
Okotoks
Cypress County
Crowsnest Pass
Fire History - 1931- 2006
0
50
100
200
300
Kilometres
Participating Municipalities
Municipal District/Counties, Specialized Municipalities
Cities
Towns/Specialized Municipalities
Burn Decade
2000's
1970's
1940's
1960's
1930's
1950's
Alberta

Figure 1.1: Alberta Wildfire History from 1931 to 2006

has experienced fewer wildfires over the last 75 years, with the majority of wildfires in this area occurring in the 1940's and 50's. In Southern Alberta, several wildfires threatened municipalities during the 1930's and since 2000. Gilbert (2007) states that:

> *"[wild]fires provide a sobering look at the impact fires have on public health and safety. Jobs are lost, businesses and social institutions are affected, infrastructure is compromised, natural resources are damaged, and lives and properties are threatened and often destroyed" (pg. 1).*

Wildfires may negatively affect human lives and structures, however they can positively affect the natural environment, as a variety of plant and tree species need fire to rejuvenate and grow (Hirsch 2004, Alberta Sustainable Resource Development undated). Allowing fire to occur in our ecosystems has been hindered over the last several decades as governments have focused on fire suppression (Peter *et al.* 2006a, Wotton & Stocks 2006, Hirsch 2004). During this time, and still today, an increased number of individuals unaware of wildfires and the threat they posed moved from urban centers to the urban fringe or to more rural and semi-rural areas (Wotton & Stocks 2006, Whitlock 2004). These individuals build residences within these environments where the wildfire fuel (vegetation) has built up due to fire suppression (Filmon 2004, Mayerfeld Bell 2004, U.S. Fire Administration 2001, USDA Forest Service 1996). In Canada, an increasing number of lives are at risk due to the thousands of human developments such as communities, recreational facilities and industrial developments that meet and are scattered throughout wildland such as forest, brush and grasslands (Hirsch 2000, Silvis Lab undated), this area is referred to as the Wildland-Urban Interface (USDA Forest Service 1996, Ewert 1993a). The increasing population living in the wildland-urban interface has caused concern for government officials, especially local governments (hereafter referred to as municipal governments). People living in the wildland-urban interface may have increased vulnerability to a wildfire due to a lack of experience and knowledge in dealing with wildfires, their potential and proximity to wildfire fuels (Wotton & Stocks 2006, Alavalapati *et al.* 2005, Cova 2005, McCaffrey 2004b).

Predicted changing climatic conditions are expected to increase the number and intensity of wildfires in Canada (Hirsch 2004). Warmer and dryer conditions will dry vegetation (fire fuel) creating supportive conditions for the ignition and spread of fire in Canada (Hirsch 2004) and elsewhere (Dovers *et al.* 2004, Whitlock 2004, Westerling *et al.* 2003). Changing conditions will also create high winds, which will increase the spread and intensity of wildfires (Hirsch 2004), increasing the wildfire risk associated with living in the wildland-urban interface.

Recently, the Canadian Council of Forest Ministers created the Canadian Wildland Fire Strategy. This strategy has been designed to balance social, ecological, and economic aspects of wildland fire, to improve and renew current and future fire management practices. The Canadian Wildland Fire Strategy is designed to 1) foster resilient communities and empower the public, 2) develop healthy and productive forest ecosystems, and 3) incorporate modern business practices (Natural Resource Canada 2007, Canadian Council of Forest Ministers 2005). This strategy was developed due to three primary catalysts: 1) the impact of unwanted wildfires, especially the wildfire events that occurred in western Canada in 2003, 2) acknowledgement of declining suppression capacity and the need to introduce wildfire mitigation alongside fire suppression, and 3) a growing awareness and concern among Canadians regarding potential threats to life, property, and the environment (Canadian Council of Forest Ministers 2005).

In addition, increasing costs of equipment, personnel and infrastructure affect the ability of Canadian governments (federal, provincial/territorial, and municipal) to effectively respond to and suppress a wildfire, and as a result they have identified the need to take a more proactive approach to reducing a wildfire risk (Wotton & Stocks 2006, Filmon 2004).

1.2 Wildfire Risk Management

There are four hazard management stages: mitigation, preparedness, response and recovery (Tierney *et al.* 2001). Mitigation refers to long-term actions made well in advance of a hazard occurring that reduce a community's vulnerability to the event (Public Safety Canada 2007b, Tierney *et al.* 2001). Wildfire mitigation measures can include vegetation management and structural measures that will increase a building's resistance to a wildfire (Partners in Protection 2003a). Preparedness involves having prior planned and implemented resources (e.g. mutual-aid agreement and an evacuation plan) that are implemented when a hazard such as a wildfire appears to be moving towards populated areas (Public Safety Canada 2007a, Partners in Protection 2003a, Tierney *et al.* 2001). Response includes the actions taken during and after the disaster impact to reduce causalities and damage within an area, such as providing evacuation warnings telling people to leave an area (Public Safety Canada 2007d, Tierney *et al.* 2001). Recovery involves repairing, rebuilding and reconstructing damaged property after a hazardous event such as a wildfire (Public Safety Canada 2007c, Tierney *et al.* 2001). Recently, there has been a shift in hazard management from response and recovery to incorporate mitigation and preparedness (Pearce 2003). This study will focus specifically on wildfire mitigation and preparedness (hereafter referred to as wildfire risk management) at the municipal government level.

There are seven measures that are recommended by Partners in Protection (2003) that can be used by municipal governments for wildfire risk management:

(1) Communication,
(2) Wildfire hazard assessments,
(3) Vegetation management,
(4) Structural measures,
(5) Infrastructure measures,
(6) Land-use planning, and
(7) Emergency preparedness plans.

Communication is the process of informing the public, municipal council and departments about the risks of wildfires, the damage they can cause, and the wildfire risk management measures that can be implemented by municipal governments and homeowners to reduce the threat of a wildfire. Communication can be one-way or two-way. For example, one-way communication occurs when municipal governments distribute information to the public using brochures, pamphlets, bill stuffers, radio and television advertising. Two-way communication involves a dialogue during open houses, informal and formal discussions.

Municipal governments can implement two types of **wildfire hazard assessments**. The first assesses the flammability of property and surrounding vegetation, while the other assesses the flammability of building structures to identify the potential wildfire threats that a property is exposed to. These two types of wildfire hazard assessments can be completed on both public and private lands. **Vegetation management** includes thinning, pruning and clearing of trees, brush and grasses in and around a municipality to decrease the fuel (vegetation) available during a wildfire. **Structural measures** include the use of fire retardant roofing (e.g. metal, clay, and asphalt) and siding materials (e.g. brick, stucco, concrete, and metal siding), which can be used on municipal and private buildings. **Infrastructure measures** include adequate road widths for fire fighting vehicles and ensuring appropriate water supplies for fire suppression.

Land-use planning measures include bylaws, subdivision design and development, and buildings codes. Bylaws allow municipal governments to regulate through legislation the use and development of land within their jurisdiction, including restricting building and subdivision development in high hazard areas (Hofmann undated). Subdivision design and development may increase protection for subdivisions by providing multiple access routes in and out of an area, ensuring adequate water sources to extinguish a wildfire, and creating larger lot sizes to increase space between structures adding further protection if a wildfire were to threaten a neighbourhood. Municipal building codes could allow municipal governments to specify and enforce the use of fire resistant building materials and installation of sprinklers on municipal and residential buildings, which can help to minimize the potential damage that could occur to these structures from a wildfire (Hofmann undated).

Finally, **emergency preparedness plans** are documents prepared by municipal governments well before a wildfire that identify potential support and resources available to them that could be quickly organized in the event of a wildfire. These plans include identifying roles and responsibilities of municipal government officials, contact lists, and procedures that will be implemented in anticipation of a wildfire (Health Canada 2006). These plans also describe mutual aid agreements with surrounding municipal governments. All municipal governments in Alberta are required by law under the Disaster Services Act (D-13) to have an emergency preparedness plan (Government of Alberta 2000), however the level of emphasis placed on wildfires in each municipal emergency preparedness plan can vary greatly.

1.3 Past and Present Wildfire Management in Canada

Historically, wildfire risk management was focused on fire suppression (response) and recovery rather then including a proactive approach (mitigation and preparedness) involving activities such as land-use planning, communication programs, and vegetation management (Gilbert 2007). This was because fire had generally been viewed as undesirable, and therefore wildfires were quickly suppressed to reduce the amount of burnt land as well as loss of life, property and natural resources (Hirsch 2004). Wildfire suppression in Canada has been very effective as fire protection agencies have been able to contain 97% of all wildfires to a small size (less than 200 hectares) (Hirsch 2004). However, Canadian governments have identified that it is unrealistic to remove fire from natural ecosystems, and that wildfire risk management measures are needed to reduce the impact of a wildfire on a community (Hirsch 2004). Recently, all levels of government in Canada are considering and beginning to adopt wildfire risk management programs to assist them in effectively and proactively reducing the potential damage caused by wildfires (McFarlane 2006).

These wildfire risk management programs by municipal governments include activities such as wildfire education, vegetation management, land-use planning, structural and infrastructure measures, and wildfire hazard assessments. One program that has been adopted by numerous municipal governments in Alberta is the 'FireSmart' program, which was created by the Alberta-based coalition Partners in Protection in 1990. The FireSmart program is designed to assist homeowners and municipal governments to protect themselves from wildfires (Mottus & Bothwell 2005). Partners in Protection has created two manuals, with one for municipal governments ('FireSmart: Protecting your Community from Wildfires') and one for residents ('FireSmart: Protecting you Home from a Wildfire'). These manuals assist municipal government and homeowners by identifying wildfire risk management measures they can implement to reduce their chance of being affected by a forest fire.

1.4 Study Objectives

The objectives of this study are to explore how municipal governments in Alberta[1] have adopted wildfire risk management measures, why these measures have or have not been implemented, and why they have had successes and failures in the implementation process. The specific research questions that guide this study are:

1. *What wildfire risk management measures* (i.e. communication, wildfire hazard assessments, vegetation management, structural measures, infrastructure measures, land-use planning, and emergency preparedness plans) *have been adopted by a sample of Alberta's municipal governments?*

---

[1] Alberta was selected because this project is part of a larger funded study that examines wildland-urban interface fire risk management in Alberta.

2. *Why are some wildfire risk management measures implemented more frequently than others?*
3. *What is the municipal process for implementing the wildfire risk management measures, and how is the process implemented?*
4. *What factors appear to influence municipal governments' implementation of wildfire risk management measures, and how do these factors influence the wildfire implementation process?*

1.5 Thesis Organization

This thesis is divided into nine chapters. Chapter two describes the responsibilities of the provincial and municipal governments in the implementation of wildfire risk management measures, as well as the role of the municipal fire chief, the mayor/reeve and planner. Chapter three introduces the study area, describes Alberta's characteristics (vegetation, landscape, climate, population, municipal governance, resources and industries) that affect wildfire risk management, and describes previous wildfires that have occurred in the province. Chapter four presents the existing literature that is relevant to this research project. Chapter five describes the methods that were used to collect and analyze the data for this study. Chapter six through eight present and discuss the results of this study. Chapter six identifies and discusses the wildfire risk management measures implemented by a sample of Alberta's municipal governments. Chapter seven describes and discusses the municipal process for implementing wildfire risk management measures. Chapter eight presents and discusses the factors that influenced the implementation of wildfire risk management measures. Finally, chapter nine provides a conclusion, recommendations for municipal and provincial officials, and directions of future studies.

CHAPTER TWO

Background

This chapter describes the role of provincial and municipal governments in Alberta during wildfire risk management, as well as the specific roles of the municipal fire chief, mayor/reeve, and planner.

2.1 Role of the Provincial/Territorial Government in Wildfire Risk Management

The provincial/territorial governments are responsible for setting provincial standards (e.g. requiring each municipal government to have an emergency preparedness plan) and advising municipal governments of the risk management measures that they can implement within their jurisdiction (Murphy 2007, Wallace 1997, Kaiser *et al.* 1995). The provincial government's role is often to establish policy while the municipal government implements these policies. The provincial/territorial governments also assist municipal governments in apply standards, and provide incentives (e.g. funding) to encourage municipal governments to implement emergency management measures (Wallace 1997). Each provincial/territorial government also has their own emergency preparedness plan (Wallace 1997).

The aim of Alberta provincial government's emergency plan is to "ensure that the province can respond in a prompt and coordinated manner to disasters and emergencies" (Alberta Municipal Affairs and Housing 2000, pg. 8). Alberta's provincial government also establishes hazard communication programs, public warning systems, recruits resources to manage a hazard, and develops planning guides in advance of a disaster (Wallace 1997). The main department within the Alberta provincial government that is responsible for wildfire management is Alberta Sustainable Resource Development. Alberta Sustainable Resource Development is responsible for "encouraging a balanced and responsible use of Alberta's natural resources (lands, forests, fish and wildlife) through management, science, and stewardship" (Alberta Sustainable Resource Development 2006b, pg. 1). Alberta Sustainable Resource Development is responsible for managing the provincial crown land that falls within the area known as the Forest Protection Zone (Figure 2.1). The Forest Protection Zone covers all of northern Alberta and a thin strip along western Alberta reaching almost to the United States/Canada border, and includes approximately two-thirds of the province. Alberta Municipal Affairs and Housing is another department within the government of Alberta that plays a role in providing funding to municipal governments outside the Forest Protection Zone for the implementation of wildfire risk management measures.

Alberta Sustainable Resource Development (undated) identifies that "prevention is the cornerstone of Alberta's wildfire management system, simply because it is easier and cheaper to prevent a wildfire from starting than to put it out" (pg. 7). They aim to prevent wildfires on provincial crown land through engineering (landscape planning and vegetation removal) and enforcement (legislation and laws- e.g. fire bans), as well as providing province wide public education about wildfires and preventative measures that can be implemented to reduce the impacts of a wildfire (Alberta Sustainable Resource Development undated). They are also responsible for wildfire suppression on provincial crown land. However they will assist municipal governments at their request, to create a wildfire preparedness plan to reduce the potential threat of a wildfire, and to fight wildfires if they are beyond the capabilities of the municipal fire departments. They have also helped municipal governments outside the Forest Protection Zone by assisting with wildfire hazard assessments and creating wildfire preparedness plans if requested, although this area is not part of their jurisdiction (personal communication, Wes Nimco, Wildland Fire Prevention Officer, Athabasca).

2.2 Role of Canadian Municipal Governments in Wildfire Risk Management

Municipal governments play an important role in wildfire risk management within their jurisdiction, because the majority of emergency management activities are found at the local level (Pearce, 2003, Wallace 1997). Municipal

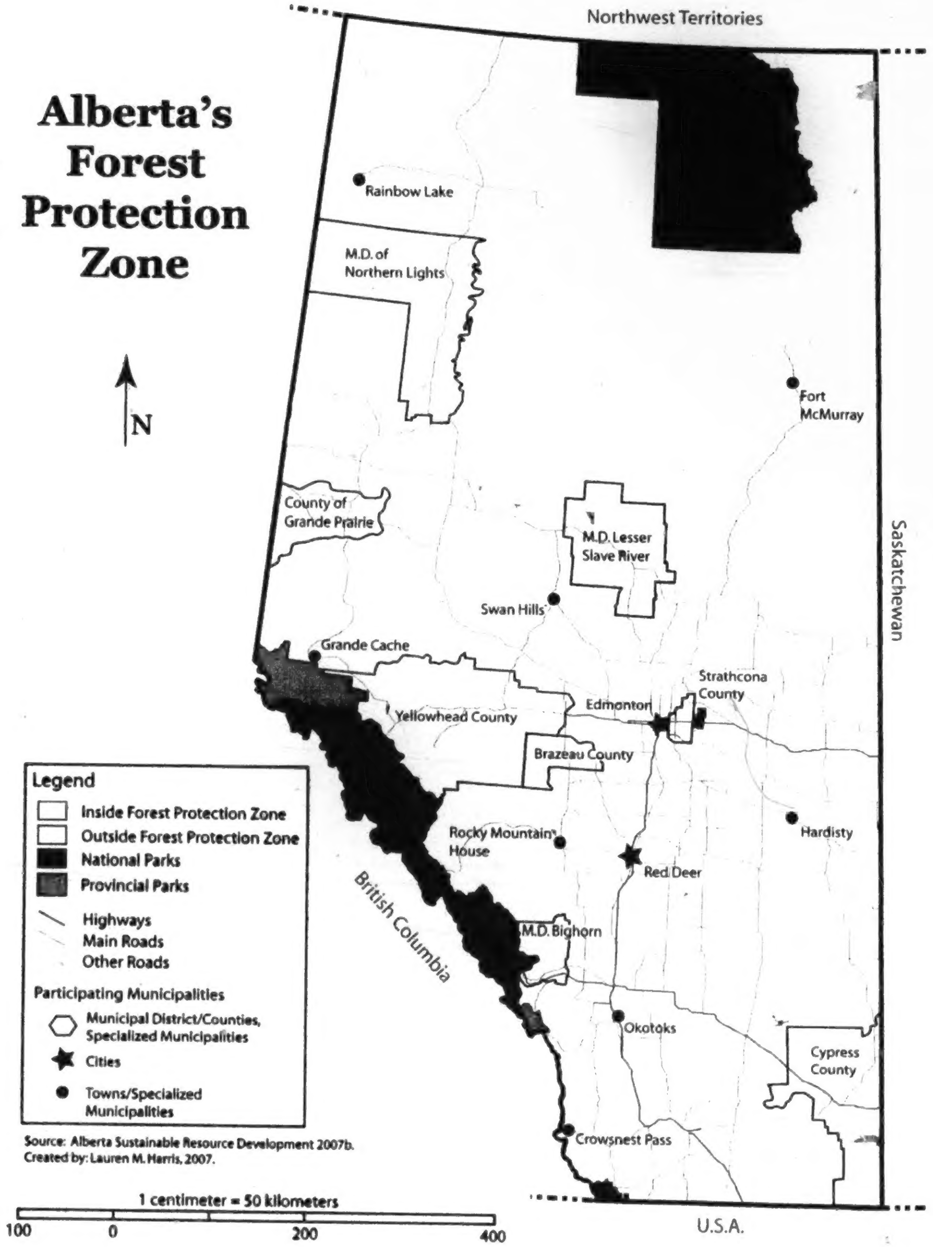

Alberta's Forest Protection Zone
N
Northwest Territories
Saskatchewan
British Columbia
U.S.A.
Rainbow Lake
M.D. of Northern Lights
Fort McMurray
County of Grande Prairie
M.D. Lesser Slave River
Swan Hills
Grande Cache
Strathcona County
Edmonton
Yellowhead County
Brazeau County
Rocky Mountain House
Red Deer
Hardisty
M.D. Bighorn
Okotoks
Cypress County
Crowsnest Pass
Legend
Inside Forest Protection Zone
Outside Forest Protection Zone
National Parks
Provincial Parks
Highways
Main Roads
Other Roads
Participating Municipalities
Municipal District/Counties, Specialized Municipalities
Cities
Towns/Specialized Municipalities
Source: Alberta Sustainable Resource Development 2007b.
Created by: Lauren M. Harris, 2007.
1 centimeter = 50 kilometers
100
0
200
400

Figure 2.1: Alberta's Forest Protection Zone

governments must also abide by the rules and guidelines set by the provincial government while addressing local geography and issues, and therefore municipal governments will create planning bylaws such as fire bans and emergency preparedness plans (Murphy 2007, Wallace 1997, Kaiser *et al.* 1995, Mallet 2005). It is the responsibility of local government to develop (shared responsibility with the provincial government) and enforce policies that mitigate and reduce the potential loss of property and life from a wildfire, and to encourage appropriate safety behaviours of individuals who choose to build their homes in high-risk areas where wildfires can occur (Gilbert 2007). There are three key municipal government officials who may be involved in wildfire risk management: The fire chief, the mayor/reeve, and the planner.

The municipal fire chief is responsible for controlling both structural fires and wildfires, and provides information to council, other departments and the public regarding potential hazardous events and emergencies (Gillespie 1991). The fire chief also reviews policies and procedures (e.g. wildfire management plans, and the municipal emergency preparedness plan), and is responsible for enforcing relevant bylaws (e.g. municipal fire bans) for the prevention, control and extinguishment of emergencies while protecting life and property (Mallet 2005, City of Grande Prairie 1989).

The role of the mayor/reeve is to consider and promote the welfare and interests of their constituents, while developing and evaluating policies and programs (e.g. see Strathcona County 2006). The mayor/reeve may provide leadership in the creation of an emergency preparedness plan (Hodge 1998, Scanlon 1990). However, research has shown that the mayor/reeve's role has often been overlooked when planning for emergencies and therefore has not been clearly defined (Hodge 1998, Scanlon 1990). This is important because the mayor/reeve, as an elected leader, often mobilizes municipal support and allocates funding for emergencies and emergency risk management measures (Scanlon 1990).

Municipal planners provide recommendations and plan how land and structures should be used and developed (Hodge 1998). According to Daland and

Parker (1962) there are four roles of a planner: (1) the planner as a leader (or representative) of the planning agency, (2) the planner as representative of the planning profession, (3) the planner as a political innovator, and (4) the planner as a citizen educator (Daland & Parker 1962). These roles can be incorporated into a planner's involvement in the implementation of wildfire risk management:

1) Municipal planners can be leaders during the implementation of wildfire risk management because they take the initiative in the development of bylaws and development plans to reduce the potential impact of a wildfire within their municipality.
2) Municipal planners are representatives of the planning profession because they can communicate with other planners and municipal officials about effective bylaws and plans that their municipality can implement to minimize the wildfire risk.
3) Municipal planners can be political innovators as they create new land-use planning approaches and bylaws to reduce a municipal wildfire threat.
4) Finally, municipal planners can be citizen educators as they communicate wildfire risk management measures (e.g. structural and infrastructure measures, and land-use planning measures) to other municipal officials, residents, developers and builders.

Planners can assist their municipal government in reducing the devastating consequences of a wildfire by advocating the use of fire resistant building materials, promoting vegetation management, and designing new fire resistant subdivisions (Hofmann & Dauk 2006). However, Hofmann (undated) indicated that municipal planners may face challenges in balancing municipal safety from wildfires with the "aesthetics and trends in housing design and landscaping" desired by residents (pg. 10). In the past, planners have appeared to ignore the need to include hazard management measures in their normal planning policies (Newkirk 2001), however this may be the result of a lack of information about the measures that are available to them (Newkirk 2001). Hofmann (undated) argues that planners must make themselves aware of wildfire issues, and by doing so can assist local fire departments and provincial forestry departments with technical expertise and insight into how others see the issue.

2.3 Chapter Summary

This chapter provides an overview of the role of Alberta's provincial and municipal governments in wildfire risk management. The role of the provincial government (specifically Alberta Sustainable Resource Development) is to provide guidelines, funding and technical expertise to municipal governments, to assist them to implement wildfire risk management measures. The provincial government also implements wildfire risk management measures (e.g. communication, vegetation management and wildfire hazard assessments) on provincial crown land.

The primary role of the municipal government is to implement wildfire risk management measures (communication, wildfire hazard assessments, vegetation management, structural and infrastructure measures, land-use planning, emergency preparedness plans) within their jurisdiction. The fire chief, the mayor/reeve, and the planner may be involved in the implementation of wildfire risk management.

CHAPTER THREE

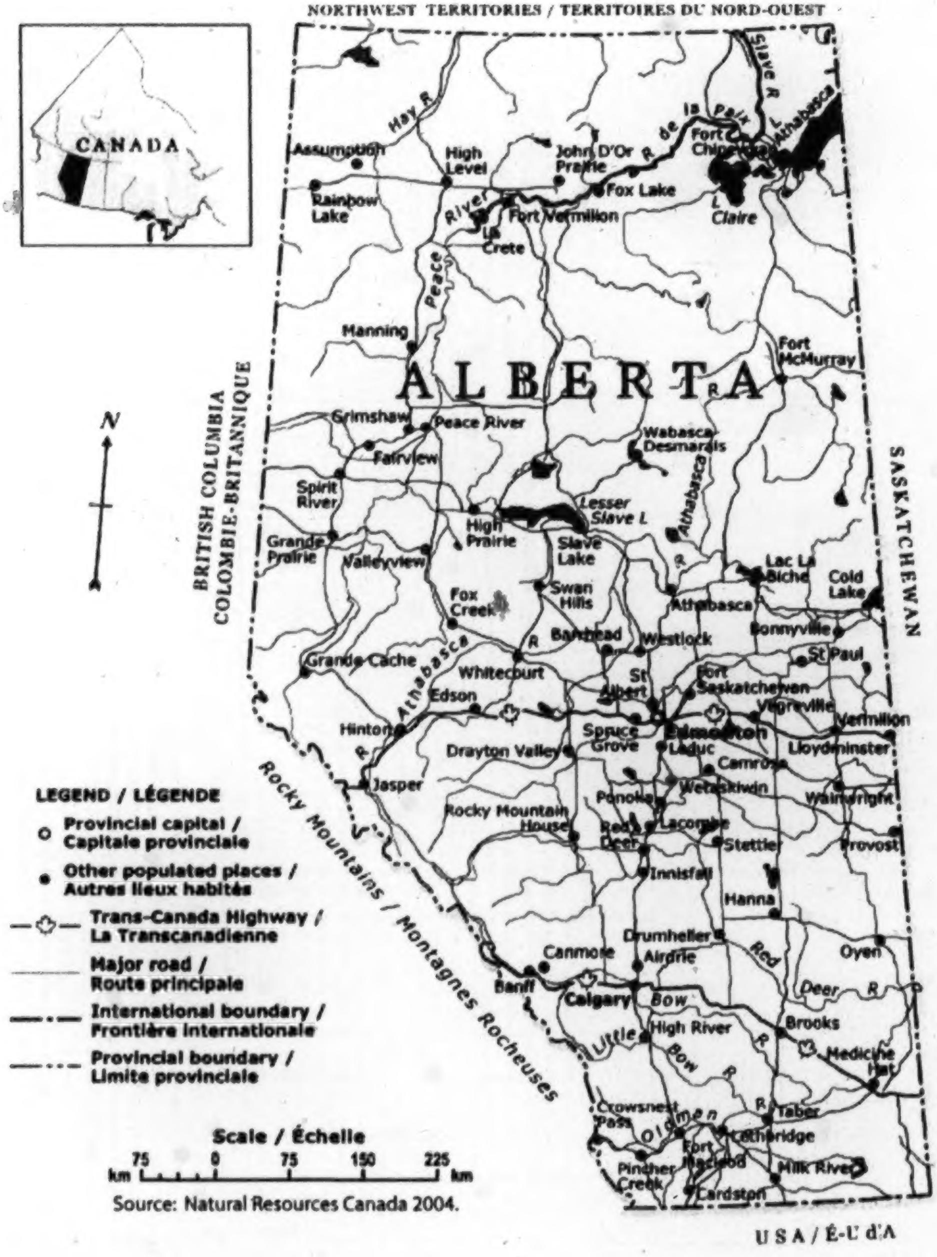
Study Area

This section describes the province of Alberta, where this study was conducted. It also describes wildfires in Alberta, and factors that contribute to the risk of wildfires in the province. This chapter will conclude by providing a brief summary of the 2006 wildfire season in Alberta, when data collection for this study took place.

3.1 The Province of Alberta, Canada

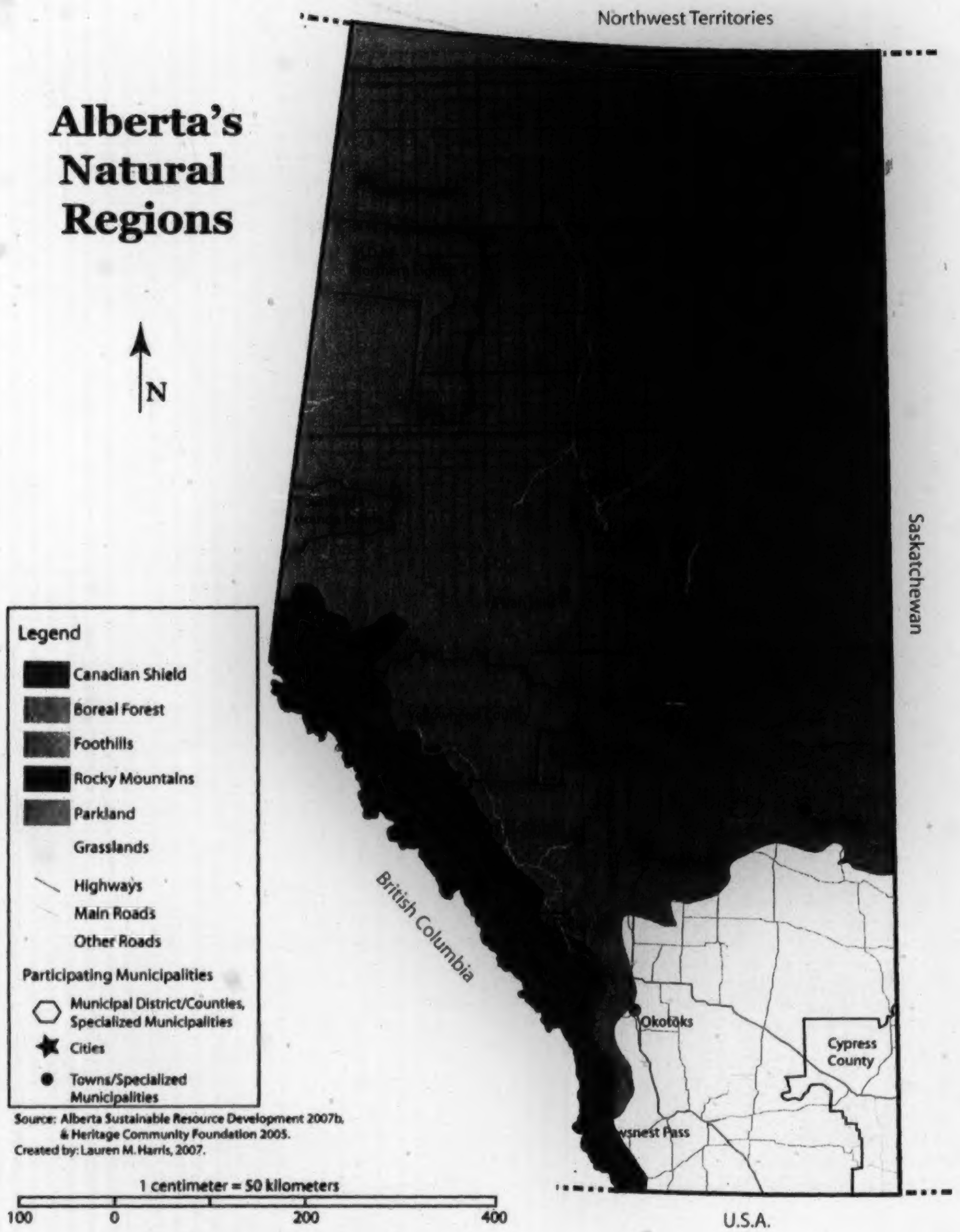
Alberta is the fourth largest province in Canada, lying between 49 and 60 degrees north latitude and between 110 and 120 degrees west longitude (Figure 3.1) (Government of Alberta 2006a). The total area of Alberta is 661,185 square kilometers, including land area and the rivers, streams and water bodies that cover 3% of the Alberta's landscape (Travel Alberta Canada 2003). Sixty-two percent of Alberta's land is provincially owned, while twenty-eight percent is privately owned, and the remaining ten percent is federally owned (including national parks, research stations, department of national defense) (Personal communication, Vanee Narayanan, Land Administration Specialist, Edmonton). Alberta is comprised of six natural regions: Canadian Shield, Boreal Forest, Foothills, Rocky Mountains, Parkland, and Grasslands (Figure 3.2).

The major vegetation types found in Alberta are coniferous, deciduous, and mixed forest stands, fescue grasses and shrubs. Coniferous forest is found in the boreal forest as well as in the Canadian Shield, Foothills and Rocky Mountain regions. The Boreal Forest region is a nearly continuous belt of coniferous forest dispersed throughout with barren land, meadows, and peatlands (Natural Resources Canada 2005, Heritage Community Foundation 2002). Tree species in coniferous forest stands in Alberta include white spruce (*Picea glauca*), black spruce (*Picea mariana*), lodgepole pine (*Pinus contorta*), jack pine (*Pinus


NORTHWEST TERRITORIES / TERRITOIRES DU NORD-OUEST
CANADA
ALBERTA
N
BRITISH COLUMBIA
COLOMBIE-BRITANNIQUE
SASKATCHEWAN
USA / É-U d'A
Rocky Mountains / Montagnes Rocheuses
Hay R.
Peace River
R. de la Paix
Slave R.
L. Athabasca
L. Claire
Lesser Slave L.
Athabasca R.
Red Deer R.
Bow R.
Little Bow R.
Oldman R.
Assumption
High Level
John D'Or Prairie
Fort Chipewyan
Fox Lake
Rainbow Lake
Fort Vermilion
La Crete
Manning
Fort McMurray
Grimshaw
Peace River
Fairview
Wabasca-Desmarais
Spirit River
High Prairie
Slave Lake
Grande Prairie
Valleyview
Lac La Biche
Cold Lake
Fox Creek
Swan Hills
Athabasca
Bonnyville
Barrhead
Westlock
St Paul
Grande Cache
Whitecourt
St Albert
Fort Saskatchewan
Edson
Vegreville
Vermilion
Hinton
Edmonton
Spruce Grove
Lloydminster
Drayton Valley
Leduc
Camrose
Jasper
Wetaskiwin
Wainwright
Rocky Mountain House
Ponoka
Lacombe
Red Deer
Stettler
Provost
Innisfail
Hanna
Drumheller
Oyen
Canmore
Airdrie
Banff
Calgary
Brooks
High River
Medicine Hat
Crowsnest Pass
Taber
Lethbridge
Fort Macleod
Pincher Creek
Milk River
Cardston
LEGEND / LÉGENDE
○ Provincial capital / Capitale provinciale
● Other populated places / Autres lieux habités
Trans-Canada Highway / La Transcanadienne
Major road / Route principale
International boundary / Frontière internationale
Provincial boundary / Limite provinciale
Scale / Échelle
75
0
75
150
225
km

Source: Natural Resources Canada 2004.

Figure 3.1: Map of Alberta


Alberta's Natural Regions
N
Northwest Territories
Saskatchewan
British Columbia
U.S.A.
Okotoks
Cypress County
wsnest Pass
Legend
Canadian Shield
Boreal Forest
Foothills
Rocky Mountains
Parkland
Grasslands
Highways
Main Roads
Other Roads
Participating Municipalities
Municipal District/Counties, Specialized Municipalities
Cities
Towns/Specialized Municipalities
1 centimeter = 50 kilometers
100
0
200
400

Source: Alberta Sustainable Resource Development 2007b, & Heritage Community Foundation 2005.
Created by: Lauren M. Harris, 2007.

Figure 3.2: Alberta's Natural Regions

banksiana), balsam fir (*Abies balsamea*), douglas fir (*Pseudotsuga menziesii*) and tamarack (*Larix laricina*). Coniferous forest is highly prone to forest fires as a result of the increased flammability rating of these tree species (Partners in Protection 2003a). Coniferous tree species, particularly jack pine (*Pinus banksiana*), need fire to stimulate their reproductive cycles (Heritage Community Foundation 2002). Prior to the adoption of fire suppression sixty years ago, a small percentage of forest was older than seventy-five years because forest fires were such a common and widespread occurrence (Alberta Sustainable Resource Development undated). Today the majority of pure conifer tree stands found in the Boreal Forest tend to be more than eighty years old and are a more flammable fuel source (Heritage Community Foundation 2002). Deciduous forest stands are found in the Parkland region, and include trembling aspen (*Populus tremuloides*), balsam popular (*Populus balsamifera*) and white birch (*Betula papyrifera*) tree species. The majority of pure deciduous stands in Alberta are less than one hundred years old (Heritage Community Foundation 2002). Mixed forest stands including both coniferous and deciduous forest species are found in the Foothills and Boreal Forest. Fescue grasses are located in the Grasslands, Parklands, and Foothills, while shrubs are found in the Parkland region. The areas most susceptible to grass and brush fires are the Grassland and Parkland regions of the province.

The ownership of Alberta's forested lands falls into three categories: provincial, federal, and private. The provincial government owns 89% of forested land found throughout the province (Natural Resources Canada 2006). The federal government owns 8% of forested land, while 3% of forested land is owned privately by individuals, often farmers, predominantly in southeastern Alberta (Natural Resources Canada 2006).

Alberta's climate is characterized by low humidity, and significant contrasts in weather found between different areas and seasons (Travel Alberta Canada 2003). In the summer, average temperatures range from 18°C in southern Alberta to 13°C in the north; winter months see an average temperature of –10°C in the south to –24°C in the northern section of the province (Agriculture, Food and Rural Development 2006). Precipitation is highest along the mountains in the southwest of the province and in west-central Alberta, while the lowest precipitation is found in the southeastern corner of the province (Agriculture, Food and Rural Development 2006). In the summer months between May 1 to August 31, precipitation ranges from just below 200 millimeters in the driest southeastern portion of the province to 325 millimeters in the mountains (Agriculture, Food and Rural Development 2006). During the remainder of the year, precipitation ranges from less than 150 millimeters in the southeastern corner of the province to more than 275 millimeters in the mountains (Agriculture, Food and Rural Development 2006). Alberta's precipitation remains low compared to the national precipitation levels that range from 100 to 1500 millimeters (International Society for Horticultural Science undated) (Figure 3.3). This is important because continued low precipitation will increase the probability of a wildfire occurring and increase the need for municipal governments to manage wildfires (Wotton & Stocks 2006).

The population of Alberta was 3,242,824 persons[2] in 2006 (Alberta Municipal Affairs and Housing 2006a). The majority of the population is found in the central and southern regions of the province, predominantly in larger urban centers, Edmonton, Red Deer and Calgary (Figure 3.4).

There are 356 municipalities in Alberta, which can be classified as urban, rural, or specialized (Alberta Municipal Affairs and Housing 2006b). Urban municipalities encompass cities, towns, villages and summer villages, while rural municipalities include municipal districts/counties, hamlets, and improvement districts. Specialized municipalities allow both urban and rural communities to coexist within a single municipal jurisdiction (Alberta Municipal Affairs and Housing 2006b). There are 16 cities found within the province of Alberta and are defined as having a populations of over 10,000 people, and have a mayor and councillors to represent their constituents (Alberta Municipal Affairs and Housing 2006b). Towns have a population between 1,000-10,000 and may also have a

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[2] This population excludes First Nations people residing on reserves.

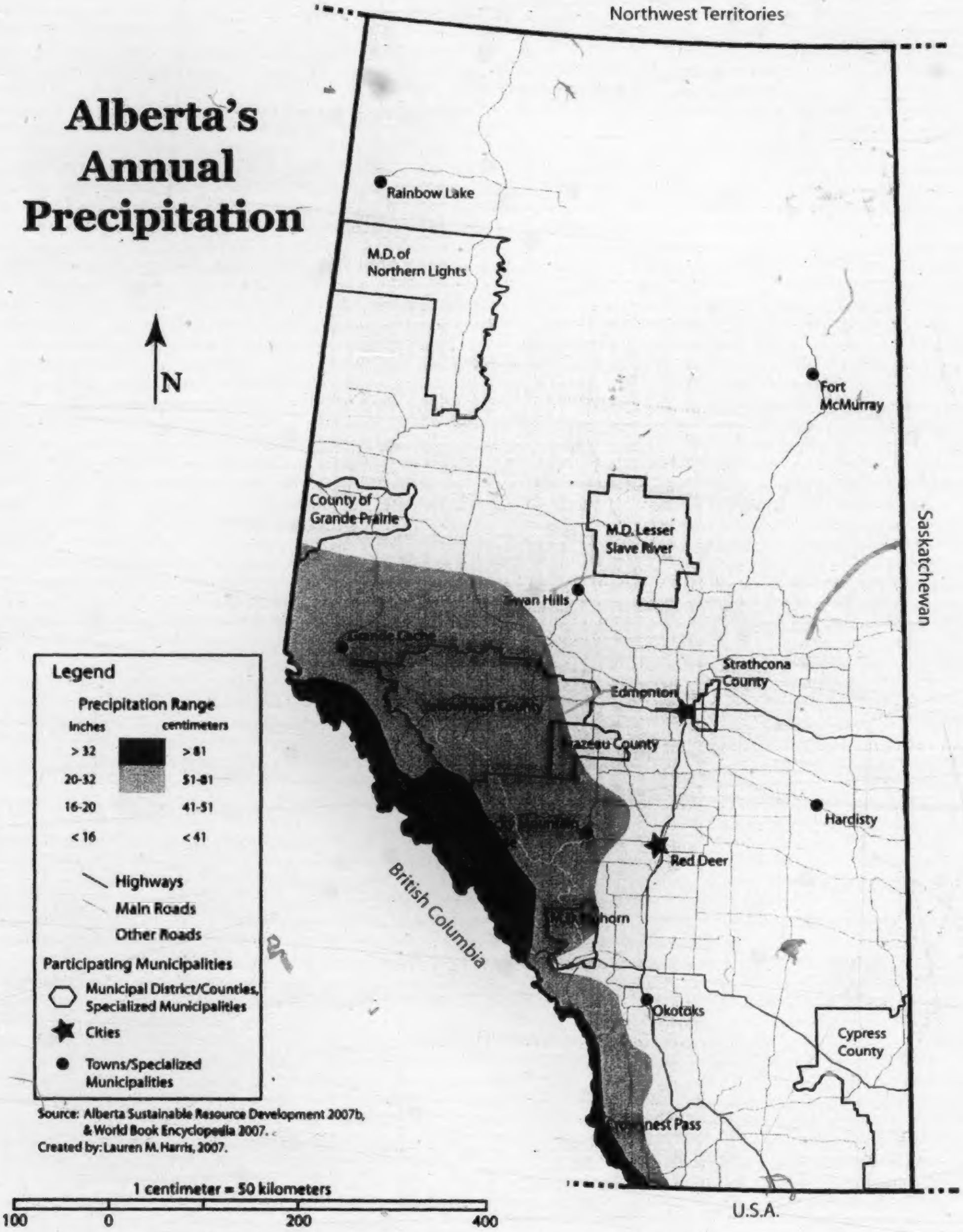
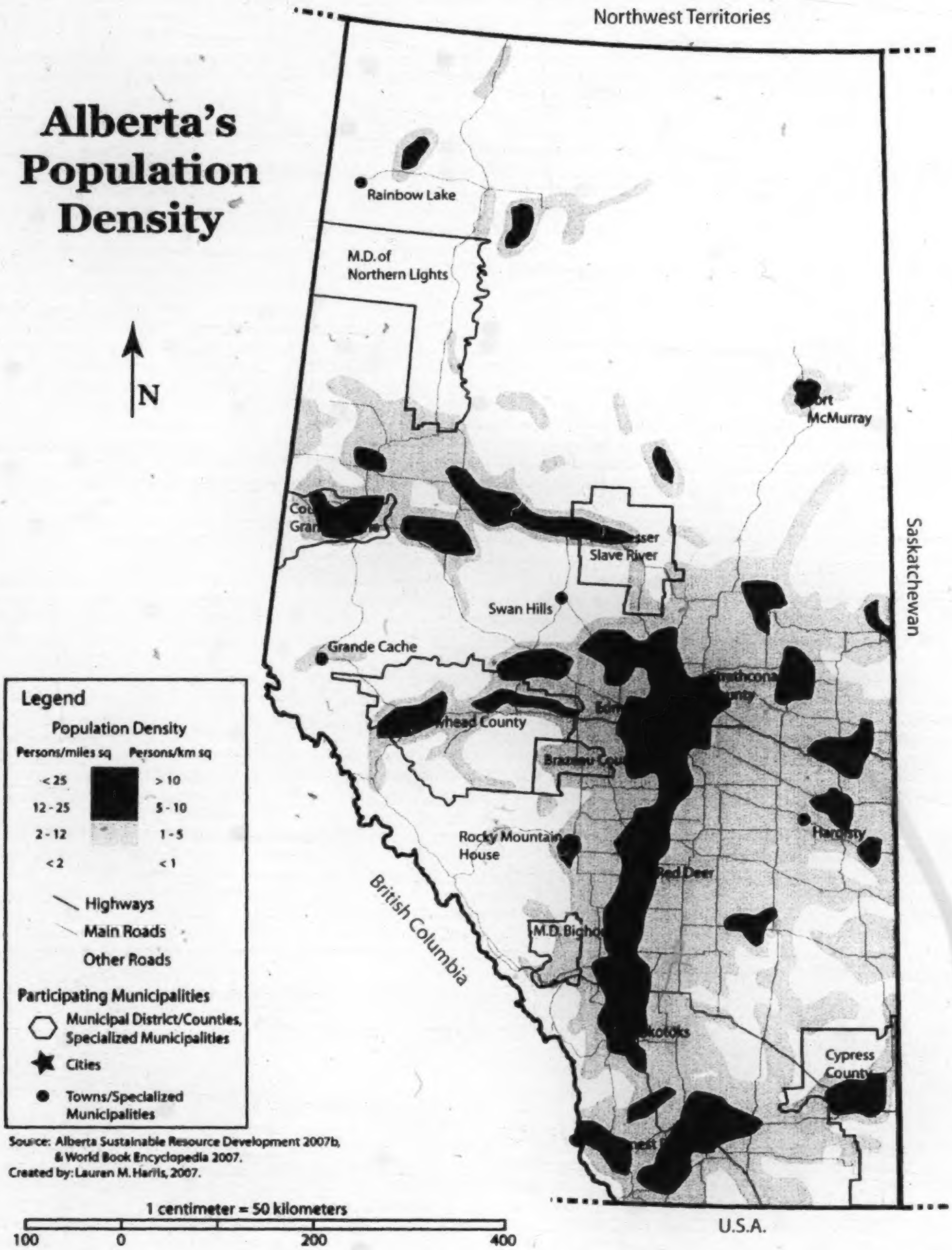

Alberta's Annual Precipitation
N
Northwest Territories
Saskatchewan
British Columbia
U.S.A.
Rainbow Lake
M.D. of Northern Lights
Fort McMurray
County of Grande Prairie
M.D. Lesser Slave River
Swan Hills
Grande Cache
Strathcona County
Edmonton
Brazeau County
Hardisty
Red Deer
Okotoks
Cypress County
Crowsnest Pass
Legend
Precipitation Range
inches
centimeters
> 32
> 81
20-32
51-81
16-20
41-51
< 16
< 41
Highways
Main Roads
Other Roads
Participating Municipalities
Municipal District/Counties, Specialized Municipalities
Cities
Towns/Specialized Municipalities
Source: Alberta Sustainable Resource Development 2007b, & World Book Encyclopedia 2007.
Created by: Lauren M. Harris, 2007.
1 centimeter = 50 kilometers
100
0
200
400

Figure 3.3: Alberta's Annual Precipitation


Alberta's Population Density
N
Northwest Territories
Saskatchewan
U.S.A.
British Columbia
Rainbow Lake
M.D. of Northern Lights
Fort McMurray
Slave River
Swan Hills
Grande Cache
Rocky Mountain House
Red Deer
Hardisty
Cypress County
Legend
Population Density
Persons/miles sq
Persons/km sq
< 25
> 10
12 - 25
5 - 10
2 - 12
1 - 5
< 2
< 1
Highways
Main Roads
Other Roads
Participating Municipalities
Municipal District/Counties, Specialized Municipalities
Cities
Towns/Specialized Municipalities
1 centimeter = 50 kilometers
100
0
200
400

Source: Alberta Sustainable Resource Development 2007b, & World Book Encyclopedia 2007.
Created by: Lauren M. Harris, 2007.

Figure 3.4: Alberta's Population Density

mayor and councillors. There are 111 towns found in Alberta (Alberta Municipal Affairs and Housing 2006b). There are 100 villages in Alberta (Alberta Municipal Affairs and Housing 2006b). Villages have a population of at least 300 people, and their council consists of three councillors, one being the mayor (Alberta Municipal Affairs and Housing 2006b). There are 51 summer villages found throughout the province in Alberta (Alberta Municipal Affairs and Housing 2006b). This particular type of urban municipal government can no longer be created in Alberta (Alberta Municipal Affairs and Housing 2006b). Municipal districts/counties are rural municipalities, which are governed by a reeve and councillors, over farmlands and unincorporated communities such as hamlets, and rural residential subdivisions (Alberta Municipal Affairs and Housing 2006b). There are 64 municipal districts/counties in Alberta (Alberta Municipal Affairs and Housing 2006b). There are approximately 339 hamlets in Alberta that are unincorporated communities within the boundaries of a municipal district/county or specialized municipality (Alberta Municipal Affairs and Housing 2006d). Hamlets consist of five or more dwellings, and contain land that is not used for residential purposes (Alberta Municipal Affairs and Housing 2006b). There are seven improvement districts found throughout the province of Alberta, the majority of them are located in the national parks (Alberta Municipal Affairs and Housing 2006b). There are four specialized municipalities found within Alberta, which include both an urban and rural area, therefore these areas have both a mayor and a reeve, which govern over their areas respectfully (Alberta Municipal Affairs and Housing 2006a, 2006b). All these municipalities rely on industry, agricultural production, and tourism for their economies, and are often surrounded by and intermingled with forests, brush and/or grasslands.

There are a number of natural resources found within the province of Alberta, leading to associated industries that extract and exploit these resources. Predominant natural resource based industries in Alberta are oil and gas, forestry, mining, agricultural and ranching activities, and tourism. These industries all play an important part in the province's economy.

Oil and gas is the largest natural resource industry in terms of revenue, producing $10 billion or 34% of Alberta's total revenues (Canadian Association of Petroleum Producers undated). Major oil and gas facilities are located throughout the province including the Boreal Forest, the Parkland region of central Alberta, and the Grasslands of southern Alberta. Wildfires can affect the oil and gas industry, as many of their facilities are located in forested, brush and grassland areas. Oil and gas companies can contribute to the risk of wildfires through their equipment such as flare stacks and personnel traveling to or working at the site.

Forest covers more than 60% of Alberta's total land base and most of this forest is found in the Forest Protection Zone. The forestry sector in Alberta employs 54,000 people and generates approximately $8.4 billion dollars in revenue (Government of Alberta 2006b). Approximately 50 municipal governments in Alberta rely on the forest sector, and 12 of these are identified as forestry dependent[3] (Alberta Forest Productions Association undated). Most of these municipalities are located in the Boreal Forest in northern Alberta, while a few are found in central Alberta in the Foothills and in the Rocky Mountain regions (Alberta Forest Productions Association undated). Wildfires can significantly affect the forest industry, because a large wildfire could burn timber that these industries depend on. The forest industry also has the potential to start wildfires from equipment used to remove trees as well as personnel traveling to and from their company's sites. These industries can also indirectly increase human-caused wildfires because individuals not working in the forest industry can access forestry roads that have be constructed to remove timber supplies.

Mining also plays an important role in the province's economy. A few of the commodities that are mined in Alberta are coal, limestone, salt, shale, sand and gravel, and oil from the oil sands. Currently 15 major mines and quarries operate in Alberta, including 11 coal and oil sands mines and four major quarries (Energy 2006). The majority of municipal governments that rely on mining for economic survival are located in central Alberta, but are also found in the

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[3] Forestry dependent municipal governments rely on the forest industry for income.

Canadian Rockies and southern Alberta. The mining industry also has the potential to start wildfires from their equipment and personnel that are working in or traveling to the mines.

The majority of agriculture and ranching occurs in the Grassland region of the province, as well as the Parkland region. The most important crops grown in Alberta are wheat, barley, canola, and tame hay. Cattle ranching is also important, and Alberta has the largest number of cattle and calf inventories at 5.9 million head or 40% of Canada's total (Government of Alberta 2006b). Wildfire risk can increase with agricultural and ranching practices because farmers and ranchers often use burn barrels and "control" burns[4] to dispose of debris. Exhaust sparks from ATVs and other vehicle activity (e.g. farming equipment) used by farmers and ranchers can also cause wildfires.

Tourism generates over $4 billion in revenues each year (Travel Alberta Canada 2003) and employs about 100,000 Albertans (Government of Alberta 2006c). Tourists interacting with nature through recreational activities (e.g. camping, hiking) can increase the risk of wildfires due to such activities as unattended campfires and ATV activities.

3.2 Alberta's Experience with Wildfires

Alberta has had extensive experience with wildfires. Data collected by Alberta Sustainable Resource Development (2007a) shows that wildfires have occurred extensively in the Forest Protection Zone (Figure 1.1). Over the past seven years, there has been an average of 1,345 forest fires per year inside the Forest Protection Zone. The 2006 wildfire season included 1,954 forest fires[5] within Alberta's Forest Protection Zone, which burned more than 11,900 hectares of forest (Alberta Sustainable Resource Development 2007a). Several of these wildfires burned quite close to towns and smaller settlements throughout the province. In southern Alberta, one community was evacuated due to a wildfire that was burning two kilometers away (Alberta Sustainable Resource Development 2007a). Out of the total number of forest fires that occurred in the Forest Protection Zone in 2006, lightening caused 746 forest fires, while 1,208 had human causes (Table 3.1). Unlike previous years, the 2006 wildfire season began one month earlier than usual, and lasted from March 1st until October 31st. This was a result of prolonged hot and dry climatic conditions across Canada, with minimal precipitation during the winter months (Alberta Sustainable Resource Development 2007a).

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[4] Fire used to remove weeds and crop residues from a field to prepare the field for new crop, requiring a permit by the fire department (British Columbia Ministry of Agriculture, Food and Fisheries 2004).

[5] These forest fires occurred inside the Forest Protection Zone and were documented by Alberta Sustainable Resource Development who monitor and suppress or assist municipal governments in suppressing these wildfires. There was no available data about other types of wildfires (e.g. brush and grass fires) occurring outside the Forest Protection Zone, therefore, 1,954 is less than the total number of wildfires that occurred in Alberta in 2006.

Table 3.1: Causes of Wildfire in Alberta in 2006

Wildfire Cause	**In 2006**	**% of Total Wildfires**
TOTAL WILDFIRES	**1,954**	-
Lightening	**746**	**38 %**
Human Causes	**1,208**	**62 %**
-Forestry Industry	25	2 %
-Oil and Gas Industry	68	6 %
-Powerline Industry	50	4 %
-Other Industry	32	3 %
-Railroad	24	2 %
-Prescribed Burn	7	1 %
-Resident	503	41 %
-Recreation	354	29 %
-Incendiary	70	6 %
-Restarted Wildfire	21	2 %
-Unknown/Under Investigation	54	4 %

(Source: Alberta Sustainable Resource Development, 2007a).

About 60% of wildfires in Alberta's Forest Protection Zone in 2006 were started by people (e.g. unattended or un-extinguished campfires, recreational vehicles), as well as industry (e.g. forestry, oil and gas, and railroad); the remaining were caused by lightening strikes (Alberta Sustainable Resource Development 2006a).

3.3 Chapter Summary

The province of Alberta has diverse landscapes (Canadian Shield, Boreal Forest, Foothills, Rocky Mountains, Parkland and Grasslands) and climatic conditions. The influx of people and industry and their equipment into these ecosystems and changing climatic conditions increases the potential threat of wildfires and is concerning for municipal governments who are responsible for emergency management activities.

CHAPTER FOUR

Literature Review

This chapter describes existing literature that frames this research, including the topics of wildfires, and the human dimensions of wildfire at the individual, community and municipal government levels. This chapter will conclude by identifying gaps in the existing literature and why this study is needed.

4.1 Wildfire Literature

Extensive literature has been published on wildfires and their physical characteristics. Several authors have described the history of wildfires (Peter *et al.* 2006a, Omi 2005, Schwab *et al.* 2005, Arno & Allison-Bunnell 2002, Pyne 1982). Researchers have also published literature on wildfire behaviour (Omi 2005, Schwab *et al.* 2005, Arno & Allison-Bunnell 2002) and the environmental impacts of wildfires on stream habitats, soil quality and stability, air quality, maintaining native plant communities, and effects on wildlife (Omi 2005, Arno & Allison-Bunnell 2002), and fuel management (Badia *et al.* 2004, Gorte 2004a, Gorte 2004b, Arno & Allison-Bunnell 2002). Researchers have also published on resources (human and equipment) that are needed for wildfire suppression (Born & Stocks 2006, Peter *et al.* 2006b, Badia *et al.* 2004), and conclude that equipment resources are aging, requiring increased funding to maintain them. In addition aging human resources could leave a shortage in personnel and expertise (Born & Stocks 2006, Peter *et al.* 2006b, Badia *et al.* 2004). Studies have also been completed on mapping techniques and predicting the future occurrence and risk of wildfires (Omi 2005, Sampson *et al.* 2000).

Some wildfire researchers have focused on the wildland-urban interface and the problem of wildfires occurring in these areas (Stewart *et al.* 2007, Haight *et al.* 2004, USDA & USDI 2001, Hirsch 2000, Ewert 1993b, Cortner & Gale

1990, Davis 1990). These researchers have identified an increasing number of individuals moving into these areas where human development intermingles with forest, brush and grasslands (USDA & USDI 2001). As a result, governments are facing new challenges in protecting these areas from wildfires and attempting to increase homeowner awareness about a potential wildfire threat.

4.2 Human Dimensions of Wildfire Literature

An increasing number of researchers are studying the human dimensions of wildfires, on topics at the individual, community and municipal government levels.

4.2.1 Human Dimensions of Wildfire Literature at the Individual Level

Research has been completed on topics including residents' perceptions of wildfire risk (McGee & Russell 2003, Winter 2003, Winter & Fried 2000, Gardner *et al.* 1987). Risk perception focuses on the judgements people make when characterizing and evaluating hazardous situations (Slovic 1987). Perception of risk has been identified as stimulating mitigation and preparedness activities (Paton 2003). McGee and Russell (2003) completed interviews with residents in one Australian community and found that these individuals had a higher perception of risk and had undertaken wildfire mitigation activities (e.g. having their own fire fighting equipment and clearing vegetation). This heightened residents' risk perception was a result of the long length of time lived in the community, wildfire experience, and social networks (McGee & Russell 2003). Winter (2003) completed a survey with residents in California examining risk perceptions and how risk perceptions affected approval ratings for wildfire management techniques. The author concluded that residents' wildfire risk perceptions varied considerably (Winter 2003), and were influenced by trust, knowledge and gender. Winter and Fried (2000) concluded that due to past wildfire experience, residents in Michigan perceived wildfires to be uncontrollable and the implementation of wildfire mitigation and preparedness measures unlikely to be successful. Gardner *et al.* (1987) examined residents in southern California and found that residents in a community that had experience with a wildfire, felt they would not be affected by a wildfire for many years.

Research has also been completed about the wildfire mitigation and preparedness measures homeowners are likely to implement on their properties (Lynn & Hill 2006, Collins 2005, McGee 2005, McGee & Russell 2003) and factors affecting what they were likely to complete (Lynn & Hill, 2006, Collins 2005, McGee 2005, McGee & Russell 2003). Lynn and Hill (2006) surveyed residents in the northwest United States and found that residents who had experienced a previous wildfire were more likely to implement mitigation and preparedness measures with the exception of planting fire resistant vegetation and installing fire resistant roofing materials compared to residents without experience. Collins (2005) found that amenity value conflicts, institutional determinants, and political economic constraints influenced household wildfire risk management decision making. The study found that participants were relatively vulnerable because the value they attached to their environment, leading to their desire not to implement wildfire mitigation activities. As well as the feeling that fire suppression by government could replace mitigation activities by government and residents, and that these residents lived in areas that did not physically and financially support fire safety, so their was no reason to spend money and implement mitigation and preparedness measures (Collins 2005). McGee (2005) and McGee and Russell (2003) identified that the majority of resident participants complete at least some wildfire mitigation and preparedness measures on their own properties. McGee (2005) found, however, that these wildfire measures may be completed for reasons other then reducing the wildfire threat.

Researchers such as McGee (*in press)*, McFarlane (2006), Shindler & Toman (2003), Vogt (2003), Winter (2003), Manfredo *et al.* (2001) have examined residents' support for wildfire risk management measures. McGee (*in press*) concluded that measures that impacted residents the least (e.g.

communication, vegetation thinning, and restricting where people can build their homes) had higher levels of support from homeowners, compared to prescribed burning. Shindler and Toman (2003) concluded that the relationship between managers and the public also influences residents' support for the implementation of wildfire risk management measures. Vogt (2003) examined homeowners in California, Colorado, and Florida and found that within each state resident approval of fuel management measures (prescribed burning, mechanical fuel reduction, and creating defensible space) varied. Based on experience, due to familiarity and success with prescribed burning residents in Florida were more likely to support this measure, whereas residents in Colorado and California were more likely to support mechanical fuel reduction and requirements for residents to create defensible space on their properties (Vogt 2003). Winter (2003) found that the majority of residents in California were concerned about wildfires and were supportive of controlled burns, restrictions on use, wildfire signage identifying the wildfire hazard rating, but were not supportive of placing bans on mechanically based recreational uses (e.g. ATVs). Winter (2003) identified trust, demographics, and perceptions of risk as factors affecting homeowners' support for wildfire risk management measures. Manfredo *et al.* (2001) concluded that perceptions of risk and knowledge about wildfires and fire policy could influence public support for wildfire risk management measures.

Several studies by Brenkert *et al.* (2005), McCaffrey (2004b), Monroe & Nelson (2004), and Rohrmann (2000) have been completed on the use of educational materials (e.g. brochures, television, personal contact) to increase homeowners' implementation of wildfire mitigation and preparedness measures, and their support for wildfire risk management measures. Brenkert *et al.* (2005) found the residents in one county in the United States felt that there was an abundance of information about wildfires and how to implement wildfire mitigation and preparedness measures however they were overwhelmed by the implementation process itself. These residents identified that they were more likely to implement wildfire mitigation and preparedness measures if one-on-one information was provided, rather than general non-specific information (Brenkert *et al.* 2005). McCaffrey (2004b) surveyed residents in a United States community to determine the effectiveness of educational materials (e.g. newspapers, magazines, television, and neighborhood meetings) and found that the use of educational tools such as neighborhood meetings, which targeted specific audiences increased residents' perceptions of wildfire risk more than using general media sources (television, newspapers, and magazines). Monroe and Nelson (2004) found that if printed materials about wildfire and how to minimize the threat of wildfires also included information about associated benefits (e.g. increased visibility of wildlife), this could help entice residents to implement wildfire mitigation and preparedness measures even if they perceive that a wildfire threat is low. Rohrmann (2000) concluded that short one-issue leaflets and comprehensive booklets are useful depending on the message being delivered. He found that illustration and materials in colour are expected, however the use of colour may be better in attracting attention than enhancing the reader's understanding (Rohrmann 2000). 'Fill-in-yourself' sections (e.g. checklists) are appreciated but not widely used, and videos, realistic footage and practical advice if accompanied by a booklet that further explained specific issues and wildfire measures would increase their usefulness (Rohrmann 2000).

4.2.2 Human Dimensions of Wildfire Literature at the Community Level

Literature has also been published on community mitigation and preparedness for wildfires. The concept of 'community' has many different meanings (Ganz *et al.* 2007, Stokowski 2007, Flint & Luloff 2005). In this thesis, the concept of 'community' includes three common elements that appear in much of the literature: 1) "people living within a specific area, 2) sharing common ties, and 3) interacting with one another" (Stokowski 2007, pg. 167). Therefore, community preparedness for wildfires refers to the collective social action taken by individuals and local government officials to implement wildfire mitigation and preparedness measures within the areas they live, work and play. Researchers such as Lang *et al.* (2006), Jakes *et al.* (2004), Steelman and Kunkel (2004), Zaksek and Arvai (2004), Jakes *et al.* (2003), and Kruger *et al.* (2003a) have published work on community wildfire preparedness. Lang *et al.* (2006) interviewed community leaders in three United States communities, to examine the role and characteristics of these leaders that motivated residents to become involved in wildfire preparedness. The authors concluded that the community leaders became involved in wildfire preparedness because they are motivated by their job, concerned about personal property and the safety of others, and may have been requested by other individuals to become involved. They also found that these community leaders brought unique skill sets with them to their job, including knowing their constituency, communicating with others, working towards a goal, using residents' talents, and delegating tasks. Community leaders were also residents themselves and as a result had increased knowledge of their community and the individuals within it (Lang *et al.* 2006). Lang *et al.* (2006) also found that leaders acknowledged that motivating individuals and facilitating activities was more important than directing individuals and activities.

Steelman and Kunkel (2004) identify factors that influence the execution and enforcement of wildfire plans at the community level. The authors concluded that the implementation of structural measures (e.g. using fire resistant building materials, completing vegetation management, and land-use planning measures) could be limited by a lack of community involvement in decision making and planning for selecting structural measures (Steelman and Kunkel 2004). Steelman and Kunkel (2004) also concluded that communities must find their own long-term solutions for mitigating and preparing for a wildfire, as each community has their own individual problems and concerns that they must resolve relating to their wildfire implementation process.

Jakes *et al.* (2004) completed case studies in 15 communities across the United States to determine the mitigation and preparedness activities that were being implementing, and the social conditions required to carry out these activities. The results of these case studies indicate that all communities are able to take some steps to increase their wildfire preparedness (Jakes *et al.* 2004), however, wildfire preparedness can be improved if a community obtains resources such as the talents of individuals (e.g. agency employees and the public), and uses networks of existing organizations found within their area (Jakes *et al.* 2004). Finally, Jakes *et al.* (2004) found that community wildfire preparedness cannot occur solely by one individual or agency, and requires collaboration and partnerships between managers, decision makers and the public.

Zaksek and Arvai (2004) completed a study in British Columbia, Canada, to identify how fire management professionals and residents conceptualize wildland fire and their associated risk and benefits, while identifying gaps in these individuals' knowledge levels. These authors concluded that residents have a "less complete overall understanding of the mechanics, risks, and benefits of wildland fire" (Zaksek & Arvai 2004, pg. 1508) compared to the fire management professionals. This difference in expertise between fire management professionals and residents can affect community level preparedness because residents must be informed through communication programs, so they may be able to play a more meaningful role in risk management discussions. Effective community level preparedness can also be affected by the lack of knowledge and skills of fire management professionals which are necessary when planning and carrying out effective risk communication to increase their residents' knowledge levels (Zaksek & Arvai 2004). These authors concluded that an understanding of how people conceptualize wildfire risk and risk management is needed prior to investing resources in creating and implementing wildfire risk communication methods and materials.

Kruger *et al.* (2003a) examined five communities in the Unites States, and found that although landscape conditions and ecological factors (e.g. forest type, age distribution, and forest health) varied between each community, four factors contributed to wildfire preparedness in each of the five communities. These factors were: 1) developing effective educational materials, 2) the importance of networking and building connections, 3) coordination between residents and government, and 4) identifying individual and community responsibility for protecting homes and properties from a wildfire.

Jakes *et al.* (2003) developed a community wildfire preparedness model, based on their research in the United States, which has been used by other wildfire researchers to examine wildfire preparedness measures implemented by homeowners in Australia and the United States (McGee & Russell 2003, Kruger *et al.* 2003a), and factors influencing the implementation of these measures. This model identifies five factors that increase a community's wildfire preparedness, including social capital, human capital, cultural capital, agency involvement, and landscape. The factors included in the Jakes *et al.* (2003) community wildfire preparedness model may also influence municipal governments' implementation of wildfire risk management measures in Alberta. An explanation of the five factors identified by Jakes *et al.* (2003) will be discussed below.

Jakes *et al.* (2003) defines social capital as characteristics such as leadership, networking and the mobilization of resources which all contribute to the collective social action of a community when implementing wildfire risk management measures. Leadership of emergency officials (e.g. fire, police, and emergency services) and elected officials (e.g. the mayor/reeves and councillors) is important when preparing for disasters (Lang *et al.* 2006), however is often over-looked (Eggleston & Koob 2004). Leadership activities can range from communication with the public to keep them informed, to determining if evacuation of an area is necessary. Eggleston and Koob (2004) concluded that the leadership of local government is necessary for building communities resilient to hazards and emergencies. Strong networks between key informants such as government agencies, industry and business representatives, and residents, have been found to increase a government's ability to implement mitigation and preparedness measures for floods (Shrubsole 2000). Scanlon (1991) concludes that networking between local government and the public was necessary to assist municipal governments in the management of hazards, because resident support for the implementation of emergency management measures will increase the effective implementation of these measures. Municipal governments can be hindered in implementing emergency management measures if conflict occurs between different municipal officials (e.g. planners and fire chiefs) regarding what particular emergency management measures a municipal government should implement, as each member may have their own preconceived ideas based on past experience (Kartez & Lindell 1990). The mobilization of resources involves ensuring that there is an emergency plan, adequate funding, personnel, equipment, and other resources, if a disaster were to occur. This kind of resource mobilization has been found by numerous researchers to increase municipal government's ability to implement risk management measures for wildfires (Cottrell 2005, Reams *et al.* 2005, Steelman *et al.* 2004, Jakes *et al.* 2003, Ballart & Riba 2002), floods (Shrubsole 2000), and general hazard management (McEntire & Myers 2004).

Human capital has been defined by Jakes *et al.* (2003) as an individual's knowledge and skills obtained through their education and training. Land-use planners' knowledge of hazard management measures may affect, both negatively and positively, municipal governments' ability to implement land-use planning for wildfire risk management (Hofmann & Dauk 2006, Gordon 2001). If municipal planners are aware of risk management measures, they will be able to use their skills and training to implement planning tools (e.g. bylaws, subdivision development plans, and building codes) to increase wildfire protection for their municipality (Gordon 2001). A planner's knowledge of wildfire risk management measures will also assist them with informing the public about these measures (Hofmann & Dauk 2006). The knowledge and skills of individuals within a fire department obtained from their education and training can positively affect the implementation of wildfire risk management measures. Fire chiefs and other members of the fire department are trained to understand the damage fire can cause and the importance of implementing preventative measures to minimize this potential damage. Levels of public knowledge regarding wildfires and wildfire measures affect municipal governments' ability to implement wildfire risk management measures (Jakes *et al.* 2003). Jakes *et al.* (2003) concluded that successfully implemented wildfire risk management measures in a community in the United States was due to the knowledge and skills of local residents who provided their expertise regarding the development of communication materials (e.g. pamphlets) that were specific to local ecological conditions.

An individual's knowledge and skills obtained through their heritage, experience, and attachment to place are characteristics that Jakes *et al.* (2003) identifies as being part of cultural capital. An individual's heritage affects the desire to implement wildfire risk management measures because knowledge and skills learnt from previous generations assist municipal government officials in identifying wildfire risk management measures that have worked in the past and those wildfire measures that do not. Experience with previous wildfires could influence municipal wildfire preparedness by increasing the knowledge and skill level of individuals (Jakes *et al.* 2003). Municipal governments that have just experienced a hazard such as a wildfire may be more likely to immediately manage for another wildfire (Plevel 1996), or a similar hazard (Tierney *et al.* 2001). Attachment to place recognizes that individuals may have different values regarding an area where they live or visit, resulting in varying perceptions about how land should be managed (Yung *et al.* 2003). Understanding municipal officials and the publics' attachment to place is important for local government officials because it can connect to "attitudes and expectations from individuals about appropriate and inappropriate management or use" of the space (Kruger & Jakes 2003b, pg. 820).

Agency involvement was another factor identified by Jakes *et al.* (2003) as contributing to a community's wildfire preparedness. Jakes *et al.* (2003) states that agency involvement can include one agency (e.g. a municipal government) working alone, several agencies working independently but towards a common goal (e.g. several municipal governments), or multiple agencies working together as a team (e.g. municipal and provincial government, and industry). Agency involvement allows increased access to funding, resources, and expertise that assist in the effective implementation of wildfire risk management measures (Jakes *et al.* 2003).

Finally, Jakes *et al.* (2003) identified geography, such as isolation, and private and public ownership of land as influencing a community's wildfire preparedness. Jakes *et al.* (2003) provides an example from Gunflint Trail in the United States and concludes that this community has been effective in wildfire preparedness because the residents acknowledge that their community was isolated from much of the state and they needed to take action themselves to protect their community and could not rely on other agencies to protect and save them from the impact of a wildfire.

4.2.3 Human Dimensions of Wildfire Literature at the Government Level

Little research has been published on government involvement in wildfire risk management, government implementation of wildfire risk management, and factors affecting the implementation process. Only a few researchers in the United States (Plevel 1996, Reams *et al.* 2005, Steelman *et al.* 2004), and the Mediterranean (Ballart & Riba 2002), have examined federal, state/regional and/or local/municipal governments' implementation of wildfire risk management measures and the factors that affect their implementation process.

Steelman *et al.* (2004) examined federal and state governments' influence on local governments' ability to manage wildfire threats in the United States. The United States federal government directs local government wildfire risk management through policy direction and grants, while the state government provides access to funding, technical assistance, and policy guidelines (Steelman *et al.* 2004). Steelman *et al.* (2004) concluded that the federal and state governments strongly impact the implementation of wildfire risk management measures at the local government level by providing (or not providing) them with funding and support to create wildfire management plans.

Ballart and Riba (2002) identified government measures such as human participation in identifying the ignition of new wildfires, and determining daily climatic variables, as important factors in regional governments' preparation for forest fires in northeastern Spain. The study concludes that in anticipation of wildfires and in preparation for their management, regional governments must have planned and easy access to sufficient resources (e.g. helicopters), well-trained volunteers, and knowledge of local geography and climate.

Reams *et al.* (2005) and Plevel (1996) have studied wildfire risk management by local governments in the United States. Reams *et al.* (2005) sent surveys to managers in charge of state, county, and local risk management programs in the United States, to identify: 1) the specific risk management activities being implemented in these areas, 2) the most effective program tools or activities, and 3) the amount of collaborative planning and the parties involved (Reams *et al.* 2005). Reams *et al.* (2005) also identified obstacles affecting the implementation of these programs and the program activities that had been the most effective. The main obstacles identified in their study were the lack of resources (funding and staff with expertise) and a negative attitude from residents (public apathy and resistance of residents to complete vegetation managements). However, the Reams *et al.* (2005) study provides little insight into how the wildfire risk management measures were completed, or who was involved in the process. This study will incorporate some of the questions asked by Reams *et al.* (2005), and will examine if the obstacles to implement wildfire risk management measures in Alberta are similar to those found in this United States study.

Plevel (1996) examined factors influencing local governments' ability to implement policies geared towards reducing the potential impact of a wildfire in wildland-urban interface communities in the United States, through three case studies in Orange County and Oakland in California, and Eastern Pima County in Arizona. Plevel (1996) found that eight factors influence local government's ability to implement wildfire policies. The first factor was acknowledgement and understanding that wildfires pose a risk to local government jurisdictions and require local policies to address the issue. The second was competing values and interests in local government leading to conflicts between needing safety measures (e.g. vegetation management) and natural spaces. The third factor was the perceived authority of local government and their departments to act on wildfire policy. The fourth factor was participation in policy-making by vocal wildfire experts (government and non-government individuals) and concerned citizens who need to keep the wildfire problems in front of council and the public policy agenda. The fifth factor was the window of opportunity to implement wildfire preventative measures, as legislative action appears to be more acceptable immediately following a wildfire event. The sixth factor was the cost of implementation, and who funds these initiatives. The seventh factor identified was the political influence of a politician's desire to enhance their chances for re-election by focusing on issues of high current value to their constituents, which may not include the implementation of wildfire risk management measures. The eighth factor was fear from elected officials about the possibility of litigation from implementing ineffective wildfire mitigation efforts. This current study will build on Plevel's (1996) work by determining if municipal officials in Alberta, Canada are experiencing similar factors that influence their implementation of wildfire risk management measures. This study will also expand on Plevel's (1996) work by identifying the level of involvement and role of municipal planners in the implementation process, and identify why some wildfire risk management measures were more frequently implemented than others.

In addition to the factors identified by Jakes *et al.* (2003), other hazard researchers have identified bureaucratic issues and competing municipal resource interests as reducing the ability of municipal governments to implement hazard risk management. Conflicts of interest between municipal governments, conflict within a municipal government, and conflict between a municipal government and the public may affect a municipal government's ability to implement risk management measures for wildfires (McCaffrey 2004a, Plevel 1996, Gardner *et al.* 1987), floods (Shrubsole 2000) and general hazard management (Scanlon 1991, 1990). Conflicts of interest between municipal governments may occur when a positive hazard management measure for one municipality has negative effects on another. Shrubsole (2000) identified conflict between municipal governments in the implementation of flood management measures because upstream and downstream municipal governments may disagree over the construction and operation of structural adjustments (e.g. construction of a dam). Conflict could occur when one municipal government constructs a dam within their jurisdiction, which in turn leads to flooding of an upstream municipality. Municipal government services such as police, parks, and water are often in higher demand than implementing hazard management measures, because hazards occur less frequently than the demands placed on these other services (Plevel 1996, Davis 1990). This competition between local government responsibilities appears to reduce the implementation of wildfire risk management (McCaffrey 2004a, Plevel 1996, Davis 1990) and other hazard risk management measures (Godber *et al.* 2006, Perry & Godchaux 2005, Shrubsole 2000, Scanlon 1991). Competition between municipal government departments may be seen in requests for funding. The mayor/reeve and councillors will more likely implement day-to-day operations that the public wants (e.g. fixing municipal pot holes) ahead of programs that will protect against 'infrequent and unpredictable' events (such as wildfires), to enhance chances of re-election (Godber *et al.* 2006, Plevel 1996). Conflict can also occur between a municipal government and local residents. Conflict can occur between a municipal government and the public if residents mistrust the government and are excluded from the decision making process (Shindler and Toman 2003). Conflict can also occur if the public does not support their local government's plans for wildfire risk management as the residents feel that the wildfire measures will have a negative impact (e.g. removing or thinning vegetation on public land located right behind residential properties).

4.4 Chapter Summary

Extensive literature has been published on the physical characteristics of wildfires, their complexities, and the wildland-urban interface. A small but growing literature has also been published on the human dimensions of wildfire at the individual and community levels. However, there appear to be studies focusing on the government level, and a search of the literature revealed only two studies on municipal government implementation of wildfire risk management measures, how they implemented these measures and the factors influencing implementation. Importantly, Plevel (1996) and Reams *et al.* (2005) did not examine the role of municipal planners in wildfire risk management, despite their significant role in planning the use and development of land within a municipality, which could significantly influence the impact of wildfires. If planning measures are incorporated into municipal government wildfire management plans, this may help to reduce wildfire damage within the wildland-urban interface (Buchan 2006, Schwab *et al.* 2005, Partners in Protection 2003a, Gordon 2001, Rice & Davis 1991, Hofmann undated). I am not aware of any studies that examined the role of the municipal planner during wildfire risk management. This study will also examine whether factors identified by Jakes *et al.* (2003) and others (Reams *et al.* 2005, McCaffrey 2004a, Plevel 1996, Davis 1990) affect Alberta's municipal governments in the implementation of wildfire risk management measures. These are the gaps this study will fill.

CHAPTER FIVE

Methodology

This chapter presents the two-phase methodology used for this study. Phase one involved a survey followed by a telephone interview with the fire chief, the mayor/reeve, and planner with a sample of 18 municipal governments across Alberta. Phase two involved in-person interviews with municipal government officials, business and industry representatives, provincial government officials, resident and environmental group participant from two municipalities included in phase one.

A quantitative and qualitative research approach was used from this study. A inductive approach was used to allow a hypothesis to be generated once the data had been collected and analyzed, rather then a deductive approach where a quantitative researcher begins with a specific hypothesis to be tested (Schwandt 2001). This study used non-probability sampling methods. Purposive sampling was used for both phases of the study. The sample population – fire chiefs, mayors/reeves and planners – was predetermined because these officials are most likely to have some involvement in and influence on wildfire risk management. The subgroups of purposive sampling that were used were quota sampling for phase one and maximum variation sampling for phase two for the selection of municipalities, and a chain referral technique was also used for phase two, to select participants (e.g. provincial government representatives, residents, business and industry representatives). These techniques will be discussed below in their respective sections.

5.2 Phase One

The purpose of phase one was to collect information from selected municipal officials (fire chief, mayor/reeve, and planner) to answer *what* wildfire risk management measures their municipal government was implementing, *why* some wildfire measures were used more frequently than others, *what* is the process for implementing wildfire risk management measures, and *how* are they implemented, *what* factors influence the implementation process, and *how* they influence the process. The fire chief, mayor/reeve and planner were selected because they may be involved in wildfire risk management decision-making and implementation within their municipality. These municipal representatives from a sample of municipalities throughout Alberta completed a brief written survey to provide information about *what* wildfire measures their municipality was implementing. Following the survey, a semi-structured telephone interview was completed with the municipal participants to gain in-depth information about *why* some wildfire measures were more frequently implemented, *what* was the wildfire implementation process, *how* the wildfire risk management measures were implemented, *what* factors influenced the wildfire implementation process and *how* they influenced the process. The survey and telephone interviews took place from May to September 2006.

A quota sampling method was used to select a sample of municipalities. This technique was used to ensure that one or more municipal governments were selected from each of the selected sample criteria. The sample criteria included municipalities in a variety of Alberta's natural regions, those with different primary land-uses, municipalities that had different municipal government specifically cities, towns, municipal districts/counties, and specialized municipalities (Table 5.1). These criteria were selected to ensure a diverse sample of Alberta's municipalities was represented.

It is expected that municipal governments will vary in their ability to implement wildfire risk management measures, providing an opportunity to identify the factors that affect the implementation process. Representatives from Alberta Sustainable Resource Development, the Canadian Forest Service, and a consultant assisted during the selection of the municipal governments to be included in the sample, since they were able to provide information about the general characteristics of the municipal governments and the municipality. Initially, 15 Alberta municipalities (45 municipal participants) were selected to participate in this study. It was determined after this initial selection that there were still gaps in the geographical distribution of the sample municipalities, and this resulted in three more municipalities added, leading to a final sample of 18 Alberta municipalities (Table 5.1). In total 54 municipal officials (fire chief/deputy fire chief, mayor/reeve, and planner) were asked to participate in this study, and 38 municipal officials actually participated by completing telephone interviews during phase one (response rate: 70%). Telephone interviews were conducted with 16 fire chiefs/deputy fire chiefs, six mayor/reeves, seven planners, and nine chief administrators (councillors, Chief Administrative Officers, Director of Disaster Services, and Director of Emergency Services). One municipal official completed the survey but did not complete the telephone interview, in phase one.

The 18 municipal governments that participated were located throughout the province of Alberta. Almost two-thirds of participating municipalities were found within the Forest Protection Zone, while the remaining third were located outside this area. The 18 municipalities included seven municipal districts/counties, two specialized municipalities, two cities, and seven towns. Three municipalities were located in the Boreal Forest region, two in the Rocky Mountain Region, four in the Parkland region, two in the Grasslands, and two municipalities were found in the Foothills regions. Four participating municipal jurisdictions were located in both the Foothills and Boreal Forest regions, and one was located in the Foothills and Rocky Mountain regions (Figure 3.2). Six participating municipalities were located in northern Alberta, where forestry and oil and gas industries are predominant. Nine municipalities were located in central Alberta where ranching and forestry are the primary land-use. Three municipalities were located in southern Alberta where agriculture and ranching are the primary land-use. All of the participating municipalities had been identified by municipal participants as having some experience[6] with wildfires within the last 20 years (Figure 1.1)[7]. The population of the selected municipalities ranged from 760 to 862,544 people (see table 5.1).

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[6] Municipal experience with a wildfire is when a wildfire occurred within or close to municipal jurisdiction and affected people's health, structures and/or infrastructures.

[7] This map only shows wildfires that have occurred inside the Forest Protection Zone.

Table 5.1: Table of Participating Municipalities and their Characteristics

Municipality Name	Municipality Type	Population (2006)[1]	Natural Bioregions[2]	Principal Industry[3]
Bighorn	Municipal District	1,264	Rocky Mountains/ Foothills	Oil & Gas, Forestry, Mining, Hydro-electric, Tourism
Brazeau	County	7,040	Foothills/ Boreal Forest	Oil & Gas, Forestry, Agriculture, Tourism
Crowsnest Pass	Town	5,749	Rocky Mountains	Oil & Gas, Forestry, Tourism
Cypress	County	6,729	Grassland	Oil & Gas, Agriculture, Military
Edmonton	City	730,372	Parkland	Manufacturing, Tourism
Fort McMurray	Specialized	51,496	Boreal Forest	Oil and Gas, Forestry, Mining
Grande Cache	Town	3,783	Rocky Mountain	Oil & Gas, Forestry, Mining
Grande Prairie	County	17,970	Boreal Forest	Oil & Gas, Forestry, Agriculture, Tourism
Hardisty	Town	760	Parkland	Oil & Gas, Agriculture, Tourism
Lesser Slave River	Municipal District	2,820	Boreal Forest/ Foothills	Oil & Gas, Forestry, Agriculture, Tourism
Northern Lights	Municipal District	3,772	Boreal Forest/ Foothills	Oil & Gas, Forestry, Agriculture, Tourism
Okotoks	Town	17,145	Grassland	Manufacturing, Construction
Rainbow Lake	Town	965	Boreal Forest	Oil & Gas, Forestry
Red Deer	City	82,772	Parkland	Manufacturing, Tourism
Rocky Mountain House	Town	6,874	Boreal Forest/ Foothills	Oil & Gas, Forestry, Agriculture, Tourism
Strathcona	Specialized	82,511	Parkland	Oil Refineries, Agriculture
Swan Hills	Town	1,645	Foothills	Oil & Gas, Forestry, Hazardous Waste Plant
Yellowhead	County	10,045	Foothills	Oil & Gas, Forestry, Mining, Agriculture, Tourism

(Adapted from: [1] Statistics Canada 2007, [2] Heritage Community Foundation 2005, [3] AlbertaFirst.com 2006).

Contact information from potential municipal participants was collected from relevant websites (Alberta Fire Chiefs Association, Alberta Urban Municipality Association), municipal websites, and by telephoning the municipal office. Once municipal representatives' contact information was collected, a letter of research intent, consent form and survey were sent by fax or email to the three municipal officials who were invited to participate (fire chief, mayor/reeve, and planner) in each municipality. One week after the information packages were sent out, initial phone or email contact was made with each participant to ensure they had received the package, answer any questions they had about the study, and to find out if they would be willing to participate. A least one municipal representative (fire chief/deputy fire chief, or mayor/reeve, or planner) from the 18 municipalities agreed to participate in the study. The individuals who were willing to participate were asked to sign the consent form and complete the survey and return it by fax or email prior to the telephone interview. In some participating municipalities, the deputy fire chief participated in place of the fire chief. In other cases, the information package for this study was forwarded to municipal councillors, Chief Administrative Officers, Directors of Disasters Services, and Directors of Emergency Services by the originally intended municipal participants (e.g. the mayor/reeve, planner), because these other municipal government representatives were felt to have a better understanding of wildfire risk management measures being implemented by their municipality. Therefore, the actual respondents who participated in this study were broader than the planned initial target group (fire chief, mayor/reeve, and planner). The addition of these other municipal officials to this study identified that within a municipality there can be a variety of municipal officials who are responsible for the implementation of wildfire risk management, other than the fire chief, mayor/reeve, and planner. The inclusion of these other municipal officials also allowed for a more detailed understanding of municipal wildfire risk management because in some cases the Director of Disaster Services was responsible for wildfire risk management not the Fire Chief. In a few other cases, councillors were more involved in communication with the public and municipal officials than the fire chief, mayor/reeve and planner.

A written survey (see Appendix C) was designed to identify *what* wildfire risk management measures each municipality was implementing or planning to implement. Using a survey allowed participants to answer questions in their own time, and allowed them to confirm information if required. The survey was quantitative and the questions were dichotomous 'yes', 'no' questions. The results of the survey were used to identify how many of the 18 participating municipal governments were implementing wildfire risk management measures. Questions from the survey asked *what* wildfire risk management measures outlined from the FireSmart manual (Partners in Protection 2003) (communication, wildfire hazard assessments, vegetation management, structural measures, infrastructure measures, land-use planning, and emergency preparedness plans) municipal governments in Alberta were implementing, as well as asking if the municipal government was implementing any other wildfire risk management measures. However, the survey did not ask specific questions about each measures, such as what types of communication techniques were being implemented within each municipality. Survey questions also asked about a municipality's wildfire experience over the last 20 years[8], and the potential type of wildfire(s) (grass fire, brush fire and/or forest fire) that could occur in their municipality in the future.

Once the survey had been completed and sent back to the researcher, the results were followed up during the telephone interview, using a qualitative research approach, which focused on *why* some measures were more frequently implemented than others, *how* the measures identified in the survey were being completed (*who* was involved in the process, *when* and *where* the measures were/are being completed), and *what* is the process for implementing wildfire risk management measures and *how* are they implemented, *what* are the factors that influence the wildfire implementation process and *how* do they influence the process. Identifying *what* wildfire measures the municipal government was implementing based on survey responses, also allowed for new probing follow-up questions to be identified before the interview.

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[8] The timeframe of 20 years was selected as a gauge of time in which participants would remember the wildfires that occurred in their municipality.

The semi-structured telephone interviews lasted approximately one hour, were tape-recorded, and later transcribed for analysis. Telephone interviews were chosen over in-person interviews because they allowed for a more geographically diverse sample of Alberta municipalities to be included. Using telephone interviews decreased the amount of travel time, resources and cost that would have occurred had these interviews been conducted in-person (Robson 2002). Increased challenges would have occurred if these interviews were completed in-person as three municipal officials from each municipality were sought to participate in this study and they may not have all been available simultaneously. The telephone interview approach allowed municipal participants to select a interview time between May and September 2006. Semi-structured telephone interviews were selected as a follow up to the written survey to allow for open-ended interview questions, which take into account individual's varying backgrounds, attitudes and experiences. Open-ended interview questions allow participants to speak freely and not be restricted in the comments they provide (Robson 2002) about specific questions regarding *what* wildfire measures their municipal government was completing (e.g. what communication techniques is the municipal government implementing), *how* the measures were being completed and the factors influencing the implementation process and *how* they influenced the process. For example, when asked '*what* factors have helped your municipal government implement wildfire risk management measures and how?,' participants were free to speak about factors that they felt were important to their municipal government's implementation of wildfire risk management measures, which may not have been relevant to other municipal governments. This method allowed participants to provide detailed and in-depth responses, allowed clarification of interview questions where needed, and allowed the incorporation of new questions (Robson 2002). However, using telephone interviews had the limitation of the interviewer missing non-verbal cues which may have assisted in understanding the verbal responses from the participant as well as missing visual aids (e.g. maps and municipal documents) which the participant may have used in in-person interviews to assist in providing the interviewer with a better understanding of the message the respondent wanted to deliver.

Dichotomous 'yes', 'no' questions from the Reams *et al.'s* (2005) study regarding wildfire risk management measures that state and local governments in the United States were completing, were incorporated into the survey and telephone interview guide. This permits a comparison of some results of this study with the Reams *et al.* (2005) study in the United States. Questions were also added to find out about participants' perceptions of wildfires; how prepared they felt other municipal officials, residents/businesses and industry in their municipality were for a wildfire; the experiences that have contributed to their perception of wildfires; and the factors that have influenced their municipal government's ability to manage wildfires (see Appendix D).

5.3 Phase Two

The purpose of phase two was to obtain more detailed information (a qualitative approach) about *how* the wildfire implementation process was being completed in two participating municipalities, as well as *what* factors influenced this process and *how* they affected the process. Phase two involved selecting two municipalities that had participated in phase one, and conducting semi-structured in-person interviews with stakeholders in each municipality including industry and business representatives, a provincial government official, a resident and environmental group leader, and other municipal representatives. These individuals were selected to participate because they could have an influence on their municipal governments' implementation of wildfire risk management measures.

Municipality 'A' was selected because it had implemented a significant number of wildfire risk management measures (communication, vegetation management, structural and infrastructure measures, land-use planning, emergency preparedness plans and wildfire hazard assessment). Only one person (the fire chief) had participated in phase one, so it was felt that more detail could be collected in phase two about *how* the wildfire risk management measures were being completed, and *how* the factors identified in phase one influenced the wildfire implementation process. This municipality is found within the Forest Protection Zone, forestry and oil and gas were predominant industries in the municipality, and the population was less than 11,000 people.

The second municipality, municipality 'B', was selected because it had experienced setbacks during the implementation of some wildfire risk management measures. This perspective was important because as more municipal governments become interested in implementing wildfire measures, they can learn from the challenges encountered by other municipal governments that have tried to implement wildfire risk management measures. Municipality 'B' is outside the Forest Protection Zone in the parkland region, and contains industries and businesses surrounded by agricultural land-use. The population in this municipality was above 11,000 people.

Sixteen participants participated in phase two from the two municipalities. Ten participating individuals were from municipality 'A' and six were from municipality 'B'. These in-person interviews took place between November and December 2006, lasted approximately one hour, and took place at the interviewee's place of work.

During phase two, a maximum variation sampling technique was used because this method allowed the researcher to purposely select two municipal governments at each end of the spectrum with regards to their implementation of wildfire risk management (one municipal government that had successfully implemented all seven wildfire risk management measures and another municipal governments that had implemented some wildfire measures and had to halt work on vegetation management in a particular area of the municipality because of public upset). This use of extreme cases allowed detailed insights into what factors influenced implementation of wildfire risk management.

Contact information for the majority of municipal officials was the same as that obtained for phase one, and contact information for those not contacted in phase one was obtained from their websites. In a few cases, a chain referral (snowball) sampling technique was used to identify other individuals that should be invited to participate. Once contact information was collected, a letter of research intent was sent to each potential participant describing the study and asking if they would like to participate. This initial contact was followed by a telephone call to each of these individuals to determine their interest in participating, answer any questions they had about the study, and to identify if they were interested in setting up a time to complete an in-person interview. Each participant completed a consent form, prior to the interview.

A semi-structured interview guide was created for these in-person interviews based on the responses from phase one. Questions were asked about *how* the wildfire implementation process was implemented, *what* factors influenced the implementation process, and *how* they influenced the process (see Appendix E). Interviews were tape recorded and transcribed for analysis.

5.4 Ethics Approval

Ethics approval was obtained from the University of Alberta Arts, Science, & Law Research Ethics Board, since data would be collected from human subjects. Participation in this study was voluntary, which allowed participants to decide if they wanted to participate (Nueman 2000). An initial letter (see Appendix A) was sent to all potential participants outlining the two phases of the project, inviting the individual to participate in the study, and identifying what was required of the individual if they chose to participate. This letter of intent also identified the project sponsors, stated that the participant was free to withdraw from the study at any time (none did) and provided contact information for the researchers. Once participants had read this letter, they were contacted to see if they were interested in participating. Participants were asked to sign a consent form (see Appendix B) that was sent with the letter of research intent if they wished to participate in the study, and return it before their interview. Upon completion of this study, the results will be summarized and disseminated to the participating municipal governments. It was made known to the participants that if they would like further information and the results of this study, they are welcome to contact the researcher or supervisor. Participants were guaranteed confidentiality during the reporting of this study.

5.5 Transcription, Verification, Coding and Analysis

Phase one telephone interviews were transcribed verbatim, reviewed for accuracy by the researcher, and then returned to participants (via email or regular post depending on the participant's particular preference). Transcripts were returned to participants to allow the participant to review and verify the information in the transcript and to provide them with a chance to add any additional information they felt important. The in-person interviews from phase two were also transcribed and reviewed for accuracy. During the second phase of this study, participants were asked if they would like the interview transcript returned to them. Once transcripts were verified, the data was analyzed.

Results from the written survey in phase one were entered into a Microsoft Excel© spreadsheet, tabulated, and reported in chapter six. Preliminary data analysis of the telephone interview data began by identifying major themes. Nineteen coding categories were established from the major themes. After these 19 coding categories were created, the researcher and her supervisor separately coded one interview to determine coder reliability. Once coder reliability was successfully established the interview transcripts and the coding categories were imported into the qualitative software program NVIVO 7.0©. This software allowed themes within each transcript to be grouped and analyzed further under each coding category. Pattern coding was completed next, which involved grouping similar themes together (Miles & Huberman 1994). Pattern coding allowed the data collected to be reduced into smaller groups, while retaining the detail of the responses (Miles & Huberman 1994). A graphic representation of pattern coding was also incorporated into this study, called concept mapping, which produced a visual representation of the major ideas and the interrelationships between these ideas (Trochim 2006).

Phase two coding and analysis commenced once transcripts had been verified. Since some of the interview questions varied between phase one and phase two, several new coding categories were added to the original coding framework used in phase one, to code additional major themes that emerged in phase two. The new coding categories and interview transcript were imported into NVIVO 7.0©, which allowed for the phase two data to be grouped and analyzed, similar to phase one. The new themes were also incorporated into the concept map created during phase one.

5.6 Reliability of Results

Reliability or trustworthiness of data is important and has been subject to much debate in qualitative research. This is because unlike quantitative research, qualitative research cannot easily be replicated because it uses of human subjects (Robson 2002). Therefore qualitative researchers must ensure that they have been honest and careful when carrying out their data analysis, and that they can prove to other that they have been (Robson 2002, Baxter & Eyles 1999).

To ensure the reliability of this studies data, several techniques were used. The researcher returned the participants' interview transcript, allowing the participant to review their responses and approve that the information they provided was accurate. The initial results of the study were also presented at the "FireSmart Community Series" forum held by Alberta Sustainable Resource Development in March 2007. This conference included attendees from Alberta Sustainable Resource Development as well as municipal officials (fire chiefs, deputy fire chiefs, mayor/reeves, and planners) from across the province. The government officials who attended this presentation provided feedback during a discussion period following the presentation, where the researcher asked questions of the attending municipal officials regarding their implementation of wildfire risk management. This discussion allowed the researcher to compare the results of the data analysis with the comments provided by these other municipal officials, where similar supporting and hindering factors were identified. These types of discussions also occurred when the researcher presented the initial finding to a regional committee that included participants from one participating municipality. These types of discussions are also referred to as member checking, where participants comment on the researcher interpretations of the interviews (Baxter & Eyles 1999).

5.7 Study Limitations

The major limitation of this study was due to the quota sampling method used to select a sample of municipalities to participate in this study. The quota sampling method allowed the researcher to select municipalities with specific criteria. The sample included a range of Alberta municipalities based on population, geographic location, municipal government type, surrounding vegetation, major land-use type, and location inside or outside the Forest Protection Zone. However all quota sampling is subject to bias, because the researcher can ensure that specific differences are present in their sample (Robson 2002, Neuman 2000). These differences are important because they allow for a better understanding of the factors that affect municipal governments with varying characteristics (e.g. municipal governments in differing vegetative regions, populations, municipal government types and those municipal governments found inside and outside the Forest Protection Zone). However, the quota sampling method cannot not yield a truly representative selection of municipal governments in Alberta attempting to implement wildfire risk management measures.

5.8 Chapter Summary

This study included two phases. Phase one involved the fire chief/deputy fire chief, the mayor/reeve, planner, and/or chief administrators (councillors, Chief Administrative Officers, Directors of Disaster Services, and Directors of Emergency Services). The aim of this first phase was to identify *what* wildfire risk management measures a sample of Alberta's municipal governments were implementing, *why* some wildfire measures were more frequently implemented, *what* was the wildfire implementation process for implementing wildfire risk management measures, *how* were they implemented, *what* the factors affected the wildfire implementation process and *how* did they influence the process. Phase two involved municipal officials, provincial officials, a resident and environmental group representative, business and industry officials. The aim of phase two was to gain further insight into *how* a sample of municipal governments implemented wildfire risk management measures and *how* factors, identified in phase one, influenced the wildfire implementation process. The results of the phase one and two interviews were analyzed identifying themes and concepts that emerged from the data (Draper, 2004). The results were presented to other Alberta municipal government officials to identify the reliability of the data. The next three chapters will describe and analyze the results of this study.

CHAPTER SIX

Results & Discussion: The Wildfire Measures

This chapter will examine *what* wildfire risk management measures the 18 participating municipal governments were completing, *why* some wildfire measures were more frequently implemented than others, and *how* these wildfire measures were implemented. This chapter will focus on the seven wildfire risk management measures: emergency preparedness plans, infrastructure measures, communication, wildfire hazard assessments, vegetation management, land-use planning, and structural measures. The number of participating municipal governments that are completing each of these seven measures is identified from the written survey and summarized in table 6.1. Further details about *why* some wildfire measures were more frequently implemented, and *how* the wildfire measures were being implemented, obtained during the telephone interviews, is provided in subsequent section.

6.1 Emergency Preparedness Plans

Emergency preparedness plans include plans and procedures, contact lists and exercises to ensure a state of readiness in the anticipation of an emergency and disaster (Health Canada 2006, Alberta Municipal Affairs and Housing 2000). These plans also include mutual aid agreements with surrounding municipal governments. Mutual aid agreements will allow a municipal government to seek outside support in the form of personnel and resources if a hazard such as a wildfire exceeds local emergency response capabilities (Partners in Protection 2003a). Regular corrections, updates and reviews of this plan are required to keep municipal departments and council informed regarding their duties and the duties of other departments.

Table 6.1: Wildfire Risk Management Measures Completed by 18 Alberta Municipal Governments

Municipality	Emergency Preparedness Plans	Infrastructure Measures	Communication	Wildfire Hazard Assessments	Vegetation Management	Land-Use Planning	Structural Measures on Gov't Buildings
Municipality 'A'	Y	Y	Y	Y	Y	Y	Y
Municipality 'B'	Y	Y	Y	Y	Y	N	N
Municipality 'C'	Y	Y	Y	Y	Y	Y	N
Municipality 'D'	Y	Y	N	N	Y	?	N
Municipality 'E'	Y	Y	Y	N	?	Y	Y
Municipality 'F'	Y	Y	N	N	N	N	N
Municipality 'G'	Y	Y	Y	Y	N	Y	N
Municipality 'H'	Y	Y	Y	Y	Y	Y	Y
Municipality 'I'	Y	Y	Y	?	Y	?	N
Municipality 'J'	Y	Y	Y	Y	N	?	N
Municipality 'K'	Y	Y	Y	Y	Y	?	?
Municipality 'L'	Y	Y	Y	N	Y	N	N
Municipality 'M'	Y	Y	Y	N	N	N	N
Municipality 'N'	Y	N	Y	Y	N	N	N
Municipality 'O'	Y	Y	Y	Y	Y	?	Y
Municipality 'P'	Y	Y	Y	Y	Y	Y	N
Municipality 'Q'	Y	Y	Y	Y	Y	Y	N
Municipality 'R'	Y	Y	Y	Y	Y	?	N
Total (n=18)	18	17	16	12	12	7	4

Y = Yes, N = No, ? = Unsure

All municipal governments in Alberta are required to have an emergency preparedness plan under the provincial Disaster Services Act (D-13) (Government of Canada 2000), and all 18 municipal governments surveyed reported that they had a plan. Therefore, this wildfire risk management measure was the most frequent measure implemented by the participating municipal governments, because it was mandatory. However only ten municipal governments' emergency preparedness plans had specifically identified wildfires as a potential hazard that could threaten their municipality. Municipal participants from nine of these municipal governments stated that they had high wildfire risk areas identified in their plan. Only three of the 18 participating municipal governments had a specific wildfire reduction plan, focusing solely on the threat of wildfires within their municipality, and how the municipal government plans to handle a wildfire if one threatens their jurisdiction. This plan included information such as identifying high risk areas, the location of available resources and contact information of government officials who are in charge of their departments if a disaster occurs. Only seven participating municipal governments had established evacuation routes within their municipality to allow residents a safe and quick escape route if a wildfire threatens the municipality. When asked if they had informed the public of these evacuation routes five out of the seven municipal governments said they had.

6.2 Infrastructure Measures

Infrastructure measures include roadway access and ensuring an adequate water supply. An appropriate road width and multiple access routes can increase safety by allowing residents to evacuate an area, while still allowing emergency personnel and large vehicles and equipment into the area and providing escape routes for emergency personnel. Having a sufficient water supply is important when trying to extinguish a wildfire (Partners in Protection 2003a).

Seventeen out of 18 participating municipal governments were completing infrastructure measures. Therefore, this was the second most frequent wildfire risk management measure participating municipal governments were completing. Fourteen of the 17 municipal governments stated that they were ensuring an adequate water supply throughout their municipality for fire fighting and ensuring that road widths were wide enough to allow emergency vehicles to turn around and allow emergency vehicles into an area while allowing residents to evacuate.

The municipal departments that were involved in implementing infrastructure measures were the fire and planning departments, which were working together in the majority of these municipalities. A participant from the fire department described their department's relationship with the planning department when trying to successfully implement infrastructure measures:

> *"... [we're] working with our development people to try and make sure that they think about the different widths of roads, and turning radiuses of fire trucks, and things when they're building... subdivisions."*
>
> ***- Fire Department***

Infrastructure planning is integrated into municipal development plans. Municipal development plans are required for municipalities with a population over 3,500 under Alberta's Municipal Government Act (M-26 section 632) to outline and address future growth and development within a municipality (Government of Alberta 2007). The ability of the participating municipal governments to incorporate infrastructure measures into their municipal plans, probably contributed to this measure being the second most frequently implemented measure because once road widths, access routes, and water supply were incorporated into municipal development plans they are required in future developments. Therefore, all future planning within the participating municipalities will ensure enough water supply, appropriate road widths and access routes. When the planning department creates new subdivisions, in all participating municipal governments, the department forwards the plans to their municipal fire department for their approval of access routes, location of hydrants (if present) and road widths.

One municipality that had implemented infrastructure measures into their municipal development plans were in the process of modifying previously constructed roads to improve their road width for emergency vehicles and evacuation routes:

> *"Well, we're working on changing ... roadways that are too small and ... [roads that do] not allow the emergency vehicles in... case in point [Area A] ... there's a lot of problems with only one way in, and if we had some sort of a major event happening on the west side, it could be tough getting everybody out. As well as, at the same time... getting emergency vehicles in. So we're... working on that. That's an ongoing thing. It's fairly expensive ... because it never was dealt with when they originally built it [Area A]... it is making it a little bit more difficult because it's an expensive thing to actually do. Redo roadways, and stuff like that."*
>
> ***- Fire Department***

Fourteen participating municipal governments were ensuring that their municipality had an adequate water supply throughout their entire jurisdiction should a wildfire occur. Water sources were either man-made or natural. Man-made water sources were underground tanks, aboveground holds, dugouts, and municipal hydrant systems. Water from natural water sources was collected from rivers, lakes and ponds. The particular method of collecting water was dependent on the rural (municipal districts and counties) or urban (cities and towns) municipal status. Urban municipal governments were using municipal hydrant systems as well as underground and above ground holds:

> *"What we do there is use our hydrants systems. We have a really good hydrant system and really good pressures, throughout the town. And what we do is strategically plan, like if we have a fire roll in from this direction, what are we using here, all our strategies that we are going to use, and the tactics. As far as our hard volume hoses, and stuff like that where we can direct our*

> *portable water, portable hydrants too, and all that stuff, so we can do as much damage to the fire as we can."*
>
> ***- Fire Department***

Rural municipal governments were more likely to use dugouts, natural water sources and tankers to ensure an adequate water supply for wildfires because they did not have hydrants throughout their municipality:

> *"We do... send tankers, [and] we're in the midst of trying to make a list of where some accessible dugouts of water are."*
>
> ***- Fire Department***

New rural subdivisions were generally equipped with man-made water sources. The differences in water sources used in rural and urban municipalities reflected their size. Rural municipalities were predominantly larger and have a population spread out throughout the entire municipality, making underground water sources difficult and expensive to complete:

> *"...[natural water sources are] probably the most effective way [to collect water for wildfires], it requires less maintenance then tanks and piping."*
>
> ***- Fire Department***

Urban municipalities are smaller in size, and have a higher density of population and therefore more demand is placed on water in this type of municipality. These factors contributed to urban municipalities having underground water sources to meet the high water demands.

6.3 Communication

Communication of information through various techniques is very important for introducing municipal government officials and the public to the threat of a wildfire and the measures that can be implemented on both public and private land to reduce their chance of being affected by a wildfire. A successful wildfire risk management program depends not only on internal municipal awareness and support but it also "relies on a supportive and positively engaged public, to ensure both citizen participation and the flow of public and private funds" (Westhaver undated, pg. 2). This can only be accomplished if municipal governments regularly take time to communicate with their residents.

The results of the phase one survey indicate that communication was directed both internally and externally and was used in 16 out of 18 municipal governments. In 15 municipalities, information was communicated internally by a variety of municipal leaders (fire chief/deputy fire chief, planner, councillor, Chief Administrative Officer, Directors of Disaster Service, and Director of Emergency Services) to the remaining municipal officials (such as the mayor/reeve, councillors, planners, and other municipal government department heads).

Communication externally to residents, businesses and industries occurred less frequently. The municipal officials and departments who were involved in communicating with the public were the fire department, planning department, and chief administrators (councillors, Chief Administrative Officer, Directors of Disaster Service, and Director of Emergency Services). These municipal officials took the lead in external wildfire communication outside the Forest Protection Zone (Figure 2.1). Inside the Forest Protection Zone, the provincial government took the lead because they have specific resources and personnel devoted to wildfire education. Fifteen of the participating municipal governments were communicating with residents, seven municipal governments with local businesses, and six municipal governments were communicating with industry. Industry was communicated to less often by the participating municipal governments because industry (e.g. forestry, oil and gas, and railroad) was predominantly found on provincial and federal land, and the municipal governments would often leave communication with industry to these higher levels of government. However, a few participating municipal governments said that they would provide industry with wildfire information if an industry approached them:

> *"When we're approached for it [wildfire information we provide it but] we [as a municipality] haven't been proactive in that aspect."*

- Fire Department

A few participating municipal governments also felt that since they were communicating with residents these individuals could take the wildfire information they received and apply it to their place of work. Six out of the 15 municipal governments that had completed communication with residents said that they were planning to continue their communication efforts in the future. Municipal participants in the other nine municipalities had no future plans for specific wildfire communication with residents.

The internal and external communication methods that were used by participating municipal governments included one-way communication (radio, television ads, brochures and pamphlets, displays, bill stuffers and newsletters and newspaper ads) and two-way communication (open houses, workshops, exhibits, door-to-door, school and council presentations) methods. The majority of municipal fire chiefs/deputy fire chiefs, planners and chief administrators said that they and their departments distributed one-way information about wildfires and what the public could do to protect their homes and properties. Half of municipal planning departments were distributing pamphlets to homeowners, builders and developers to assist in the implementation of wildfire mitigation and preparedness measures on private properties.

Two-way communication occurred internally, usually during council meetings. Two-way communication also occurred externally from the fire and planning departments and chief administrators with residents. This allowed residents and other municipal officials to ask questions and gain answers from knowledgeable municipal officials, often the fire department, about wildfires and wildfire risk management measures. The fire and planning departments as well as the chief administrators were involved in two-way communication with council, other municipal departments and residents about wildfires and wildfire measures that could be implemented on public and private land. Some municipal fire department officials would go door-to-door completing wildfire hazard assessments with homeowners, identify what wildfire mitigation and preparedness measures residents could complete on their homes and properties to reduce their potential loss of their homes and properties to a wildfire:

> *"... It was a group of fire fighters from each department within the municipality... And we would take a couple of members from each department, and they would actually go around to the different landowners, and they would make suggestions on roof materials... different types of siding... try to get [residents] away from [building and using] large wood decks, and just different building suggestions."*
>
> ***- Fire Department***

This two-way communication method would allow residents to ask for clarification about certain wildfire mitigation and preparedness measures. Some planners were communicating one-on-one with homeowners, builders and property developers when they came into the municipal planning department with permits and plans. The majority of planners were providing suggestions about wildfire mitigation and preparedness measures (e.g. wildfire hazard assessments, vegetation management measures, and structural measures) that could be implemented on private properties to reduce a wildfire threat. A few municipal planners informed their homeowners, builders, and developers of regulations (e.g. bylaws) that were mandatory requirements within the municipality to ensure increased protection against a wildfire.

Figure 6.1 identifies the spectrum and use of communication techniques that were used by the 16 municipal governments to communicate with residents, businesses and industries. This figure shows that one-way communication techniques were used more frequently than two-way communication techniques, with the exception of open houses. Pamphlets were the most widely used communication method, followed by open houses and then newsletters and bill stuffers. The next most frequently used communication techniques were newspaper ads, exhibits, radio ads, municipal activities, door-to-door and one-on-one visits. Lastly, websites, workshops, school presentations, television ads, displays and practice exercises were used the least. Each of these communication techniques are discussed below.

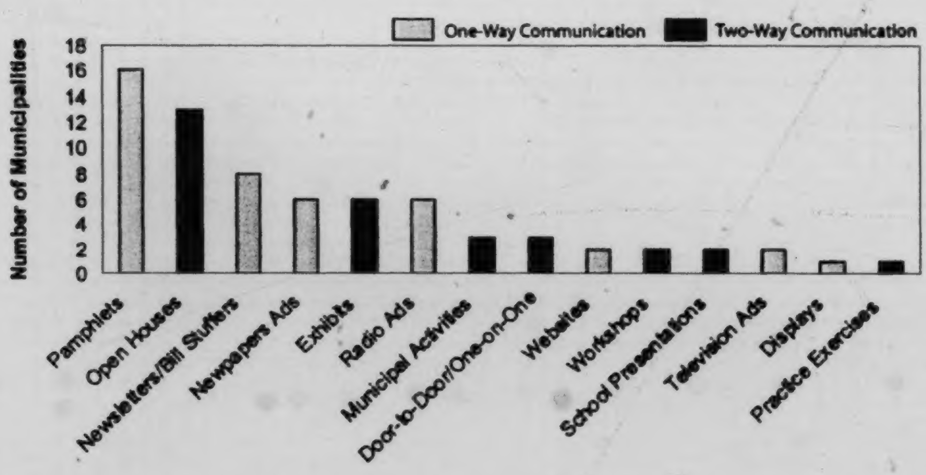

Figure 6.1: Spectrum of Municipal Communication Techniques used to Communicate with Residents, Businesses, and Industries

6.3.1 One-Way Communication Techniques

One-way communication techniques that were used by the participating municipal governments included pamphlets, newsletters and bill stuffers, newspaper ads, radio ads, website notices, displays and television ads. Each of these communication techniques and how they were used in the participating municipality will be discussed below.

Pamphlets are booklets consisting of a few pages folded together resembling a small book (see Appendix F). They were the most frequently used one-way communication method. This method was easy to use because pamphlets were designed to stand-alone, therefore require few municipal resources such as personnel to communicate its message. One municipal planner commented that they distribute wildfire mitigation and preparedness pamphlets by leaving them in the entrance to their municipal buildings or in the planning department, allowing individuals who come into the building to take a copy.

However, participating municipal governments also distributed pamphlets as part of two-way communication opportunities such as open houses, one-on-one discussions and exhibits to provide residents with printed material to take home. The majority of pamphlets that the participating municipal governments had distributed were the "FireSmart Homeowners Manual" created by Partners in Protection, which was provided to them by Alberta Sustainable Resource Development (see Appendix F). This pamphlet includes information for residents on where wildfires can occur, how to complete wildfire hazard assessments on their properties, as well as what structural materials homeowners can use on their homes and vegetation measures that can be implemented to reduce a residents chance of being affected by a wildfire (Partners in Protection 2003b). All participating municipal governments within the Forest Protection Zone used these pamphlets, while few municipal governments outside this zone used this pamphlet. This was because participating municipal governments outside the Forest Protection Zone have less contact with the provincial government regarding wildfires and this manual did not directly relate to the types of wildfires (e.g. grass and brush fires) that occur outside the Forest Protection Zone. One planning department outside the Forest Protection Zone distributed a similar pamphlet created by their municipal government. Several municipal governments appear to mail out the "FireSmart Homeowners Manual" every few years to remind their residents about wildfires and wildfire measures.

Newsletters and bill stuffers were the next most frequently used one-way communication technique. Newsletters were similar to pamphlets but were only one to two pages in length, with short articles reminding residents about the threat of wildfires and the activities property owners can implement to reduce their chance of being affected by a wildfire. A variety of topics were covered in the municipal newsletters, including wildfires. Newsletters were included within municipal newspapers, distributed on their own to residents' homes, or left in municipal buildings for residents to pick up. One participant commented on the success of their municipal newsletter, which was delivered on a monthly basis:

> *"It was in our newsletter. And everyone reads it, it's amazing, but it is very effective, and if there was ever anything that we wanted to work on in terms of partnership to getting stuff out to the community we can always do it as an insert."*
>
> ***- Chief Administrator***

Another participant commented on who receives a municipal newsletter, which covered topics about general wildfires information and how residents could prepare for a wildfire:

> *"... We have a newsletter, and we send it out to all ratepayers, so everybody that is on our tax roll, so everybody is getting it... Also we can put articles [about wildfires] in our newsletter and this goes to all of our residents and so we do that almost every year, we put something in about [wild]fires, sometimes twice depending on what the risk is like."*
>
> ***- Planner***

Bill stuffers, similar to newsletters, were one to two page documents that were sent out to residents with municipal utility bills on a monthly basis. They usually include a general reminder to homeowners at the beginning of the wildfire season and again throughout the year if there is a high wildfire hazard rating.

Newspaper ads were the fourth most frequently used communication technique. They were predominantly used at the beginning of a wildfire season to remind local residents about wildfires and that fire bans may be put in effect throughout the municipality during the wildfire season.

The next two communication techniques most frequently used were **radio announcements** and **website notices**. The information that was communicated to residents using radio announcements and website notices, similar to newspaper ads, included providing reminders about wildfires, fire bans and mitigation and preparedness measures residents could complete on their properties. Shindler and Gordon (2005) identified that websites have become a common method for distributing information, however the public does not seem to access this particular communication method very often (pg. 8). Rohrmann (2003) concludes this may be a result of some individuals' lack of experience using computers however in the future there may be an increase in the number of people using websites and computers to gather information about wildfires and wildfire risk management measures.

Television ads were used infrequently within the participating municipal governments, most likely due to their cost. Agrawal and Monroe (2006), found that the use of one-way communication techniques such as television and radio ads were positively associated with a resident's desire to mitigate and prepare for wildfires.

Lastly, **Displays** were the least frequently used one-way communication technique. Displays were used to increase resident awareness about wildfire and wildfire risk management measures. These displays were usually unstaffed booths found in malls and community centers. This measure could have been infrequently used by municipal governments because of the resources required to set up and take down the display, the possibility of the display being easily damaged because it is unattended, the expense to create a display, and because the display is only viewed by individuals who frequent the area where the display is set up (Alberta Municipal Affairs and Housing 2005).

One-way communication was used most frequently by the participating municipal governments. Rogers (2003) and Atkin (2001) concluded that mass, one-way communication techniques were helpful in providing basic information because they were relatively easy and quick to distribute, and they encouraged the public to seek additional information. Toman and Shindler (2006) also had similar findings related to wildfires. However, the use of this one-way communication approach did not provide the municipal governments with the opportunity to understand residents' concerns or their support for wildfire risk management measures, which could be determined by using two-way communication techniques. The limitations of this one-way communication approach will be discussed further in section 6.3.2.

6.3.2 Two-Way Communication Techniques

Most of the participating municipal governments also used two-way communication techniques such as open houses, exhibits, municipal activities, door-to-door and one-on-one discussions, workshops, school presentations, and practice exercises. Each of these two-way communication techniques will be discussed below.

Open houses were the second most frequently used communication technique, which was used within most of the participating municipalities (Figure 6.1). Open houses were either informal or formal meetings where information, particularly controversial issues such as vegetation management, was discussed among municipal and provincial government or private consultants and the public who attended. This information exchange provided an understanding of the need to introduce these measures and allowed individuals in the municipality to voice their concerns and ask questions. Open houses also allow municipal officials and the public to consider each other's views and opinions. Importantly, participants from the majority of municipalities where open houses had been used commented that the attendance rates were very low. In the words of two participants:

> *"...We've had open houses, advertised them heavily, and had one-, like one person would show up."*
>
> ***- Chief Administrator***

> *"Some of the earlier ones, we did, and I think over time people became comfortable. When I arrived, we were fairly late in the process and what we found was that turnout was dropping. But what I was told by others who were involved in the process, was that earlier in the process there were fairly good turnouts."*
>
> ***- Fire Department***

Attendance at open houses could have been low for a number of reasons. Firstly, municipal officials felt that the open houses were advertised heavily, however members of the public may not have seen any of the advertisements or been unable to attend on the specific open house date(s). Residents may also not have been able to attend because of the numerous other daily activities that they need to complete.

Exhibits at trade shows were an extension of displays, providing additional expertise (municipal and provincial officials) and interactive materials, 3D displays, and pamphlets. Exhibits were used more widely than displays because of the two-way communication opportunity, which allowed interaction with residents. However, some municipal governments that had used exhibits and displays, and those municipal governments that had not, felt that these two communication techniques were not enough to educate residents:

> *"Because going to a trade show and handing out pamphlets only does so much, right... They [residents] may look at the pictures. The odd person may even read it, but I mean that type of communication and education is [pause] low. You know it's not very good."*
>
> ***- Fire Department***

Municipal activities, such as holding public municipal breakfasts and street events geared at wildfire risk management were also used by several municipal governments to inform members of the public about wildfires and the steps they could take to protect their home and property. These events allowed municipal officials to interact informally with the public.

Several municipal governments sent members from the fire department **door-to-door** to communicate with residents. During door-to-door visits, municipal officials completed wildfire hazard assessments with residents on their properties, and discussed wildfire risk management measures that residents could implement. This technique was also used to inform residents in specific locations within the municipality about the wildfire measures (usually vegetation management) that the municipal government planned to implement nearby, so residents were aware of what was occurring when the municipal government began their wildfire implementation process. The door-to-door communication approach allowed municipal government members to answer questions posed by property owners. Two participants from the same municipality describe how their municipal government went about completing door-to-door communication, how long it took to complete and the feedback received from residents:

> ***Respondent C:*** *"We were knockin' on every door, and we wanted to make contact with every resident. So there was a lot of times we went back to houses several times to get them all. But yeah, 300 homes in the [town A] area. It took us 4 or 5 months to get through most of that, and then documenting, and logging it all, and getting follow up letters back out to the homeowners. It's quite timely an event. [pause] The feedback of most homeowners was good. They liked having someone talk specifically about their house because a lot of these books and that [other wildfire material] are all general, right."*
>
> ***Respondent B****: "They might point to the book, and say like 'Okay, on this section here, what do I need to do, or how does that relate to my house?'..."*
>
> ***- Fire Department***

Unfortunately, this door-to-door technique was not widely used because it is intensive, and many participating municipal governments said they did not have the necessary resources. However, many of the participating municipal governments said that they wanted to use this communication technique because they felt that residents would be more responsive.

Planners in several municipal planning departments also spoke **one-on-one** with residents, builders and developers who came into the municipal office to get approval for building and development permits. The planners communicated with these individuals about improving their building and design standards to increase their protection against a wildfire. This technique also allowed a few planning departments to explain building and subdivision regulations (e.g. bylaws) requiring builders and developers to implement infrastructure and land-use planning measures within their design concepts to reduce the impact of a wildfire.

Workshops are a series of sessions where a group of people get together and define areas of concern and work on creating solutions that hopefully will meet the varying needs and concerns of the individuals present (SIL International 1998). Workshops were directed at resident education in a few participating municipalities. **School presentations** were not widely used, despite participants' comments that children and youths playing with matches were a high cause of wildfires on their municipal lands. This communication technique would be worthwhile for many municipal governments because it could potentially lead to a reduction in children and youth caused wildfire ignitions.

Practice exercises such as involving the public in wildfire evacuation exercises were used by one participating municipal government. Evacuation exercises allowed members of the public to view and understand what would occur within the municipality if an evacuation was ordered because of a wildfire threat. This allowed residents to understand what was required of them if they needed to evacuate their municipality. It also informed residents that their children would be evacuated from their schools, and a location was identified where parents could pick up their children after an evacuation.

Two-way internal communication allowed for discussion within a municipality about various approaches to completing wildfire risk management measures and also allowed the mayor/reeve, council, and other department heads to ask questions about wildfires, and wildfire risk management measures. This two-way communication also allowed municipal officials to identify the role that other municipal departments could play in the implementation of wildfire risk management measures.

Toman and Shindler (2006), and Westhaver (undated), concluded that two-way communication techniques increase residents' involvement during the implementation of wildfire risk management measures by municipal governments, because there is more impact on residents if two-way communication occurs between a municipal governments and homeowners. Two-way communication allows the public to further understand the wildfire issues and available wildfire risk management options (Toman & Shindler 2006, Westhaver undated). The use of two-way communication techniques between a municipal governments and the public allowed for increased trust between these two groups because both groups can identify that there is an interested individual at the other end of the communication system (Shindler & Gordon 2005, Toman & Shindler 2005, Kruger *et al.* 2003a, Winter *et al.* 2002, Kramer 1999). Trust is important because it may increase public support for the implementation of municipal vegetation management and other wildfire risk management measures based on the information provided and the agencies providing the information (McFarlane 2006, Vogt *et al.* 2005). Shrubsole (2000) reported similar findings as he examined flood management in Canada and concluded that there is a lack of trust and support from the public towards governments implementation of flood management measures because residents have been excluded from the decision making process.

Rogers (2003), and Atkin (2001) also identified that two-way communication techniques allowed the public to have their questions answered which leads to increased public support and positive behaviour changes from the public. However, as noted by many participating municipal governments, and also found by Toman and Shindler (2006), Rogers (2003), and Atkin (2001), two-way communication approaches are very time consuming. Many participating municipal officials expressed an interest in completing more two-way communication techniques within their municipality, but had not done so, because it was time consuming and would require more resources (funding, time, and personnel).

In the majority of participating municipal governments, both one-way and two-way communication techniques were used throughout the entire municipality; while in a few cases, municipal governments had only communicated to residents located in identified high risk areas of a municipality, often on the outskirts of the municipality and/or along river valleys where there is a higher density of vegetation. Participating cities were predominately communicating with those individuals at higher risk of being affected by a wildfire. Cities tended to use fewer communication techniques, however they were more likely to use two-way communication, such as door-to-door techniques and open houses, because of the smaller number of people living within the high risk areas.

The majority of municipal participants agreed that communication was the most effective wildfire risk management measure along with vegetation management, however it was the third most frequently used wildfire risk management measure. Communication was described as one of the most effective because it allowed municipal officials to inform their residents about wildfire risk management measures, which in turn they hoped would lead to implementation of wildfire mitigation and preparedness measures on private property, and support for wildfire risk management by the municipal government. Other researchers including Bennett & Kalman (1999) and Willis *et al.* (1997) have also identified communication as a popular measure for residents and governments because there is a moral obligation for municipal governments to inform their residents that their health and well-being could be affected by a hazard such as a wildfire. The study by Reams *et al.* (2005) also found that both one-way and two-way communication techniques (e.g. public events, and mailings) were used by the majority of participating United States counties and states to educate councils and the public about wildfires and wildfire preventative measures. However, state and county officials in Reams *et al.*'s (2005) study focused more extensively on education and classroom curriculum, unlike the municipal participants in this study, who focused on open houses. This could have been a result of the lack of resources (see further discussion in section 8.5) that Alberta municipal governments in this study had for implementing communication and as a result, these participating municipal governments may have focused on reaching homeowners and the parents of the youth rather then the youth and children themselves.

One municipal participant commented on the importance of communication because the municipal fire department was unable to protect the entire municipality without the support and participation from their residents:

> *"The most effective [wildfire risk management measure] is providing the appropriate information to the community so that they're aware of what the risks are, and that they can participate in it. We can't accomplish reducing the risk just as a fire department; it has to be accomplished by the people. There has to be a commitment. Good communication and commitment part of it... Why do I feel that way? Because it's impossible for us [as a fire department] to do everything for everybody. Our role is to provide information to them [residents] and help them to be self-reliant."*
>
> ***- Fire Department***

Communication may lead residents to implement wildfire mitigation and preparedness measures on their own properties as well as participating in community level discussions about municipal wildfire risk management and support local government initiatives. One municipal participant indicates that they provide information to their residents so that they can make a more informed decision about the need to implement wildfire risk management measures in their municipality:

> *"Well, we're giving them [the public] the information so they can make a more, hopefully, a more informed decision... We're not forcing them by any means, as much as I'd like to have a bylaw or something that says, 'Hey, you gotta do it.' ... Around here, that probably isn't gonna happen any time soon, so, ah, I mean just, an information thing. If they're lookin' for information or if we get the opportunity to give them some, we'll do it. Give them the benefits and that sort of thing for doing it."*
>
> ***- Fire Department***

Communication is important when a municipality is going to implement vegetation management measures, because without it, the implementation of wildfire risk management measures can quickly come to a halt. In one participating municipality, a decision was made to undertake vegetation management on public land neighbouring residential homes. Once the vegetation thinning had begun there was an outcry from neighbouring residents. The municipal government had to cease the vegetation management work, return to the planning stage, and hold several open houses to inform the public why vegetation management was taking place and what the municipal government was planning to do to reduce the wildfire threat in the area. However, to date the municipal government has not restarted the vegetation management work in this particular area because of this public outcry from residents. As a result of this public outcry, municipal officials in this municipality commented that they had learned their lesson and are motivated to communicate with their residents about any future implementation of wildfire risk management measures.

6.4 Wildfire Hazard Assessments

Wildfire hazard assessments may be used by a municipal government on both public and private land to identify the potential wildfire threats that a property is exposed to (see Appendix F). There are two components to a wildfire hazard assessment, a structure/site hazard assessment and an area hazard assessment. A structure/site hazard assessment includes evaluating buildings and adjacent site characteristics (roofing material and cleanliness; building exterior material; window and door glazing; location of nearby combustibles; deck/porch material, and eves, vents and openings) to determine the level of flammability of the structure. An area assessment evaluates the potential flammability of the area more than thirty meters away from the home (property placement on a slope, surface and crown vegetation, and amount of ladder fuels) (Partners in Protection 2003b). Both of these assessments together allow for a complete picture of the potential wildfire threat to a property. The wildfire hazard assessments are a quantitative assessment where points are used to calculate the hazard level from low (<21 points), moderate (21-29 points), high (30-35 points) to extreme (>35 points) (Partners in Protection 2003a).

Twelve municipal governments out of the 18 that participated in this study identified that they had completed wildfire hazard assessments. Eight of the 12 municipal governments had completed the assessments on municipal public land, or had worked together with Alberta Sustainable Resource Development to complete wildfire hazard assessments on provincial land within the municipality (in the case of municipal districts and counties) or on provincial land surrounding towns. Eleven municipal governments had completed these assessments on private property within their municipality. The majority of these 11 participating municipal governments stated that they were filling out assessment forms with property owners and leaving further literature about what the property owners could do to lessen their chance of being affected by a wildfire. These participants also reported that in most cases, the municipal government initiated contact with residents about completing wildfire hazard assessments, rather then property owners contacting the municipal government.

Within the municipal government, the fire, planning and parks departments, and emergency services, with residents were distributing and completing the wildfire hazard assessments. Representatives from the fire, disaster services, and emergency services departments would go to resident's properties and complete and communicate the results of the assessment back to homeowners. They also provided residents a list of wildfire measures, such as vegetation management and structural measures that they could implement on their property. The planning departments were sometimes involved in wildfire hazard assessments by distributing pamphlets on how to complete a wildfire hazard assessment to residents, builders, and developers when these individuals brought in potential plans for building and development. This allowed residents, builders and developers to complete the wildfire hazard assessments themselves prior to development or while building, to increase their home and property's resistance to wildfires.

Many municipal governments in this study hired private consultants to complete their municipal wildfire hazard assessments on public lands, because these individuals have more time and expertise in completing the assessments.

Alberta Sustainable Resources Development was also involved in completing wildfire hazard assessments on municipal and provincial public lands and assisted the municipal government to communicate with residents on how to make their properties and structures more wildfire resistant. Municipal fire and parks departments in more than half of participating municipalities were completing wildfire hazard assessments on public property.

The wildfire hazard assessments completed on private property provided municipal governments with an opportunity to communicate in person the potential threat of wildfires with property owners and recommend measures that could be completed by residents. Completing wildfire hazard assessments on public land allow municipal governments to further reduce the wildfire risk by assessing areas of natural vegetation. A participant from a fire department explained that their municipal government used the data collected from a wildfire hazard assessment on public land surrounding their municipality to determine where they should complete vegetation management measures as well as future developments:

> *"We look at it and we look at our developable areas, and we say 'Where do we need to go in, and do thinning, and pruning, and 30 meter defensible zones, and what should be built here, and how should it be built?' It's very valuable information for us."*
>
> ***- Fire Department***

Eleven of the 12 participating municipal governments who were completing wildfire hazard assessments were also completing vegetation management, showing that these two wildfire risk management measures worked closely together. Wildfire hazard assessments were completed first to identify high risk areas and then vegetation management was completed in these areas to reduce the identified risk.

6.5 Vegetation Management

There are three types of vegetation management: 1) removal of vegetation, 2) reduction in vegetation and, 3) vegetation conversion. Vegetation removal occurs when wildfire fuels (vegetation) are completely removed from an area through the clearing of dense and dry vegetation (Partners in Protection 2003a). Vegetation reduction involves the thinning and pruning of low-lying vegetation to lessen the chance of ground fires spreading to the tops of trees (Partners in Protection 2003a). This is important because wildfires that occur in treetops, also known as crown fires, are more difficult to extinguish than ground fires (Schwab *et al.* 2005). Vegetation conversion is the removal of highly flammable tree/plant species, predominantly coniferous species that are capable of supporting fast-spreading and high-intensity fires and replacing them with less flammable tree/plant species (e.g. deciduous species) (Partners in Protection 2003a). All of these approaches can be completed on public land by the municipal government, or on private land by residents.

The results of this study indicate that two-thirds of participating municipal governments were completing vegetation management, specifically removal (clearing) and reduction (thinning and pruning) of vegetation within the municipal boundaries. More than half of municipal governments had created a municipal fireguard[9]. A few municipal governments were providing assistance to residents to thin, prune and clear vegetation from their property; and many municipal governments were providing residents with assistance to dispose of vegetation that they removed from their property. Fuel (vegetation) conversion was not used widely, as only a few participating municipal governments were completing this particular vegetation management measure within their municipality.

Some of the participating municipal governments that were completing vegetation management measures on public land used the opportunity to explain to residents what their property would look like if they completed vegetation management on their private properties. Some municipal participants commented that when the municipal government suggested to their residents that they should complete vegetation management on their own property, these homeowners assumed that their municipal government wanted them to clear all vegetation from their properties, which the residents did not wish to do. McGee (2005) examining the wildfire mitigation and preparedness measures that were being completed by residents along Edmonton, Alberta's river valley, and found that residents enjoyed having vegetation on their properties. McGee (2005) concluded that instead of municipal governments recommending the total removal of vegetation, that the emphasis should instead be placed on fuel conversion or less flammable vegetation species that could be planted on private property. Most participating municipal governments had not adopted fuel conversion over fuel removal and reduction.

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[9] An area of cleared land along the high risk edge of the municipality.

Vegetation management through thinning on public land assisted several municipal governments to complete other municipal activities, such as reducing mosquito and pine beetle habitat. One participant said that their municipal government planned to extend their nine hole municipal golf course to 18 holes to decrease the current fuel load around a section of the municipality. Increasing the number of holes at the municipal golf course, would also reduce the wildfire risk and create increased open space allowing for the municipal government to improve sight lines for bear, when the public is out in the municipality:

> *"...[vegetation management] really works well for us because we're reducing that fire hazard. We're also providing improved sight lines for bear, so the children can see bears when they're coming."*
>
> ***- Mayor/Reeve***

Municipal governments can also create open areas in the form of cultivated fields, parking lots, playgrounds, or sparsely forested land within their municipality to reduce wildfire fuel loads (Partners in Protection 2003a). Municipal participants commented that promoting the additional benefits associated with vegetation management increased their ability to implement this wildfire risk management measure. This was because resident support was increased for this wildfire measure, because additional municipal activities were addressed simultaneously. Other researchers, McGee (2005) and Nelson *et al.* (2004), have also concluded that residents complete vegetation management for reasons other then wildfire mitigation and preparedness, including reducing crime, increasing space for gardening, and for pets.

Municipal participants said that vegetation management was an effective wildfire risk management measure to implement because they felt that the best way to reduce a wildfire threat was to remove or reduce the potential fuel source (vegetation).

6.6 Land-Use Planning

A minority of the participating municipal governments used three land-use planning measures: bylaws, subdivision design and developments, and building codes. Bylaws allow municipal governments to regulate the use and development of land within their jurisdiction (Hofmann undated). A municipal government can require that land be zoned to identify areas that are of high risk to a wildfire and potentially restrict building in these areas. Subdivision design and development ensures that new and old residential developments are effectively protected against a wildfire, by identifying topography, parcel density, layout and infrastructure requirements (access) (Hofmann undated). By identifying these characteristics municipal governments can ensure that these areas have adequate water for fire suppression, provide building separation for defensible space[10], and provide easy access for emergency vehicles if a wildfire were to threaten a subdivision. Building codes can include requirements for sprinklers on rooftops and fire resistant building materials such as siding materials (e.g. stucco, brick, concrete, metal siding) and roofing materials (e.g. metal, clay, asphalt) (Hofmann undated). Building codes work together with subdivision design and development because implementing both of these measures increase a building's resistance to a wildfire.

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[10] Defensible space is the area around a structure where fuels have been removed or thinned to slow the spread of a wildfire towards a structure(s) (Dennis 2007).

Only seven out of the 18 participating municipal governments said they had completed land-use planning measures to mitigate wildfire risks (Table 6.1). These municipal governments identified that their municipal planning department took the lead in land-use planning for wildfires with the support of the fire department and the Chief Administrative Officer. Only two municipal governments of the five that were not completing land-use planning measures said they intending to implement land-use planning measures in the future, leaving four that did not have plans to implement such measures.

Land-use planning measures were the second least frequent wildfire measure implemented by the participating municipal governments. Only the municipal planning department could initiate land-use planning measures, and in some participating municipal governments the planning department was not involved in the implementation of wildfire risk management measures (to be further discussed in chapter eight). This could be a reason why land-use planning measures were not more widely used.

Out of the seven municipal governments that were using land-use planning measures, four were implementing bylaws, five were incorporating subdivision developments (e.g. enforcing multiple access route and water supplies), and three participating municipal governments were introducing building codes requiring residents to use fire resistant building materials on their homes. Interestingly, no participating municipal governments were minimizing or eliminating building development in high wildfire hazard areas. It appears that municipal governments in Alberta may be less inclined to implement land-use planning regulations geared at wildfire, than governments in the United States study. Reams *et al.* (2005) found that 26 of 56 state and local governments were implementing regulatory components such as subdivision regulations, development plans, and zoning (pg. 7). Only five participating municipal governments were regulating new building construction to include fire resistant building materials, while Reams *et al.* (2005) found that almost half of state and local governments were regulating new building construction. Similarly, only two Alberta municipal governments were requiring building codes on existing structures, while in the United States 15 state and local governments were enforcing regulations on retrofitted structures (Reams *et al.* 2005, pg. 7). The United States appears to have taken a more proactive approach to wildfires risk management through their land-use planning measures. However this could be because in Canada many municipal governments are just beginning to implement their wildfire risk management measures (Taylor *et al.* 2006).

6.7 Structural Measures on Municipal Government Buildings

Structural measures that can be introduced to improve a building's resistance to wildfires include fire resistant roofing materials (e.g. metal, clay, asphalt) and siding materials (e.g. stucco, metal siding, brick, concrete), small or multiple-pane windows; covering eaves and vents, and building decks and porches with non-combustible or fire resistant materials, to name a few (Partners in Protection 2003a). Only four municipal governments were completing structural measures on municipal government buildings. The other 13 municipal governments that were not implementing structural measures on government buildings had no plans to complete structural measures in the future. The implementation of structural measures on government building was the least frequently used wildfire risk management measure. It is unclear why structural measures were not completed on government buildings to reduce their chance of being affected by a wildfire. Two potential reasons why structural measures may have not been completed on government buildings could have been because of cost to change building materials that did not yet need replacing, or the cost to replace building materials competed with other municipal interests. One participant whose municipality was not implementing wildfire resistant buildings materials on government buildings said:

> *"We haven't seen that as an area that we need to be concerned with at this point."*
>
> ***- Fire Department***

One municipal participant whose municipality was completing structural measures on government buildings commented that this allowed their residents to see that their homes would still be aesthetically pleasing if they outfitted their structures with fire resistant building materials. This would possibly increase the residents desire to implement wildfire structural measures on their homes if they saw their municipal governments completing the same measures and leading by example.

6.8 Chapter Summary

Emergency preparedness plans, infrastructure measures, communication, wildfire hazard assessments, vegetation management, land-use planning, and structural measures, were being completed by some municipal governments in Alberta. Mandatory emergency preparedness plans and infrastructure measures that could be incorporated in bylaws or regulations were the most frequently implemented wildfire measures by the participating municipal governments. The majority of municipal participants stated that communication and vegetation management were the most effective measures to manage against the threat of a wildfire, however they were placed third and fifth on the list of wildfire measures most frequently implemented. Wildfire hazard assessments were fourth on the list of frequently implemented wildfire measures because municipal governments needed to identify high risk areas prior to completing vegetation management. Land-use planning measures were not implemented by many participating municipal governments, due to the lack of involvement from the planning department. Finally, implementing structural measures on municipal government buildings were the least popular measure to implement.

The results presented in this chapter provide a context for the remaining two chapters, which will identify and discuss the municipal process for implementing these seven wildfire measures (chapter seven) and the factors that have influenced the implementation of these measures (chapter eight).

CHAPTER SEVEN

Results & Discussion: The Implementation Process

The results of this study indicate that participating municipal governments were implementing wildfire risk management measures through a six-stage process. This process was identified through analysis of phase one telephone interviews and verified during analysis of the phase two in-person interviews. Data analysis involved identifying themes and relationships and simplifying them into six-stages:

Stage 1 - Initial identification of a potential wildfire problem,
Stage 2 - Gain internal support for municipal wildfire risk management,
Stage 3A- Collect resources for implementation,
Stage 3B- Update the wildfire proposal,
Stage 3C- Acknowledge external support and create an awareness of wildfire risk management measures,
Stage 4 - Communicate proposal with residents, environmental groups, businesses and industries,
Stage 5 - Implement municipal wildfire risk management measures, and
Stage 6 - Update, assess and maintain the implemented wildfire risk management measures (Figure 7.1).

Several municipal governments had successfully reached the final stage in this process within specific areas of their municipality, while other municipal governments had not yet reached the sixth stage and were still working through stage three and four. A few municipal governments that reached the sixth stage, skipped a stage or stages of the process and were hindered in their ability to effectively implement wildfire risk management measures within their jurisdiction. This chapter will describe each of these six stages and identify the factors that influenced participating municipal governments within each stage.

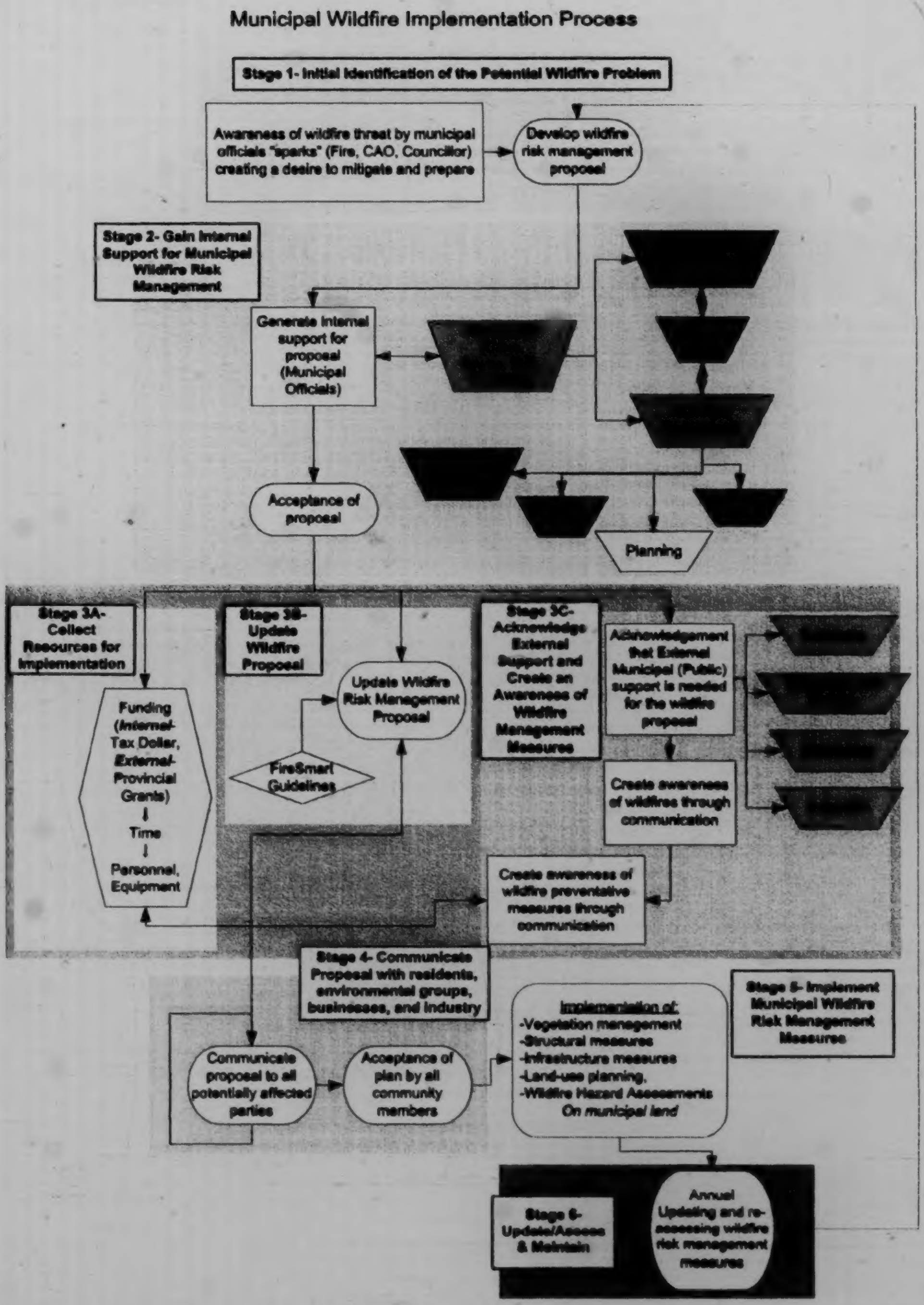
Municipal Wildfire Implementation Process
Stage 1- Initial Identification of the Potential Wildfire Problem
Awareness of wildfire threat by municipal officials "sparks" (Fire, CAO, Councillor) creating a desire to mitigate and prepare
Develop wildfire risk management proposal
Stage 2- Gain Internal Support for Municipal Wildfire Risk Management
Generate internal support for proposal (Municipal Officials)
Acceptance of proposal
Planning
Stage 3A- Collect Resources for Implementation
Funding (Internal- Tax Dollar, External- Provincial Grants) ↓ Time ↓ Personnel, Equipment
Stage 3B- Update Wildfire Proposal
Update Wildfire Risk Management Proposal
FireSmart Guidelines
Stage 3C- Acknowledge External Support and Create an Awareness of Wildfire Management Measures
Acknowledgement that External Municipal (Public) support is needed for the wildfire proposal
Create awareness of wildfires through communication
Create awareness of wildfire preventative measures through communication
Stage 4- Communicate Proposal with residents, environmental groups, businesses, and industry
Communicate proposal to all potentially affected parties
Acceptance of plan by all community members
Implementation of:
-Vegetation management
-Structural measures
-Infrastructure measures
-Land-use planning,
-Wildfire Hazard Assessments
On municipal land
Stage 5- Implement Municipal Wildfire Risk Management Measures
Stage 6- Update/Assess & Maintain
Annual Updating and re-assessing wildfire risk management measures

Figure 7.1: Municipal Wildfire Implementation Process

7.1 Stage 1: Initial Identification of a Potential Wildfire Problem

The first stage of the wildfire implementation process was the initial identification of a potential wildfire problem. There were two steps: 1) initial awareness of a wildfire threat by one or several municipal officials, leading to their desire to implement wildfire risk management measures, and 2) development of a first draft wildfire risk management proposal (Figure 7.1). All participating municipal governments had completed this first stage in the wildfire implementation process.

The first step focuses on one or several municipal officials (hereafter known as "*sparks*"), realizing and expressing concern that their municipality could be affected by a wildfire. In the majority of participating municipal governments, there was at least one *spark* who wanted to prepare their municipality for a wildfire. These individuals were usually the fire chief or deputy fire chief, but also included Chief Administrative Officers, and councillors. All these individuals had previous experience (e.g. fighting and/or witnessing a wildfire first hand), training (e.g. firefighter training) and an understanding of the impacts wildfires can have on a municipality and its residents, business, and industry. The influence of experience on this stage is discussed further in section 8.1.

Lang *et al.* (2006) interviewed ten leaders in wildfire preparedness from three communities in the United States and found that they became involved in wildfire risk management because they "cared about their personal property and the safety of other residents as well as the surrounding environment" (pg. 138). All participating municipal governments in this study had *sparks* who were deeply interested in protecting their municipality from a wildfire. Most participating municipal governments in this study identified that their government needed to implement wildfire risk management measures to protect their municipality from a wildfire. Lang *et al.* (2006) also found that leaders recognized that the wildfire issue was important enough for preventative action to be implemented in their communities. These concerns and interests expressed by the 18 *sparks* in this study, lead to their desire to implement wildfire risk management measures before a wildfire occurs, rather then waiting to respond and recover from a wildfire. The interest in the proactive approach may have been partly due to increasing costs for extinguishing a wildfire, making wildfire risk management measures more cost effective to implement (Davis 1990). Drabek and Hoetmer (1991) conclude that identifying the hazards that could affect a local jurisdiction is a preliminary step for developing a mitigation and preparedness plan.

The second step of stage one involved creating and developing a first draft of a wildfire risk management proposal. This proposal identified the wildfire risk management measures (infrastructure measures, communication, wildfire hazard assessments, vegetation management, land-use planning, and structural measures) that the *sparks* would like to implement within their municipality. A wildfire risk management proposal is a document that identifies the roles and responsibilities of municipal officials, indicates areas at high risk of wildfires, and outlines the potential activities that will be completed within the municipality to reduce the wildfire threat. The wildfire risk management proposal can be designed to manage a specific area within the municipality or can encompass the entire municipality. Larger municipalities (municipal districts, counties) and cities usually created wildfire risk management proposals for specific areas within their jurisdiction, whereas towns tended to create their wildfire risk management proposals for their entire municipality.

7.2 Stage 2: Gain Internal Support for Municipal Wildfire Risk Management

In stage two, gaining internal support for municipal wildfire risk management, there were two steps: 1) *sparks* gain internal support through communication with their mayor/reeve, councillors, Chief Administrative Officer, and other department heads (e.g. planning and parks department), and 2) municipal officials accept the first draft wildfire risk management proposal. All participating municipal governments had completed this second stage of the wildfire implementation process, however they differed in the degree of support received from municipal officials. The *sparks* took the lead during this stage of the wildfire risk management process, communicating using two-way communication techniques (e.g. one-on-one discussion and council meetings) with the mayor/reeve, councillors and other department heads, stressing the need to protect their municipality from a wildfire. In a few cases the Chief Administrative Officer was the communicator between municipal departments (e.g. fire department, disaster service department) and council (the mayor/reeve and councillors) in communicating the need for the municipal government to implement wildfire risk management measures because the Chief Administrative Officer frequently met with council and understood the need for wildfire measures to be implemented within the municipality.

During the first step in this stage, the *sparks* would table their wildfire risk management proposal at council to gain support, and resources (e.g. funding) to begin implementing the wildfire risk management measures outlined in the proposal. This is a critical step, which has also been identified by Drabek and Hoetmer (1991) for the creation of emergency plans. *Sparks* would also encourage other municipal departments, councillors, and the mayor/reeve to participate in the planning of the wildfire implementation process. An example of this would be the *sparks* indicating to the municipal planning department that their involvement in the wildfire implementation process would be an asset as they could implement land-use planning measures and could also distribute education materials (e.g. pamphlets) to homeowners, builders and developers who came into the municipal planning office. A few municipal governments gained involvement from their parks department, which in turn assisted in the completion of vegetation management measures and wildfire hazard assessments on public land, leaving the fire department with more time to communicate with residents and complete wildfire hazard assessments on homeowners' properties. Kartez and Lindell (1990) also concluded that preparedness and management of disasters would be improved when multiple municipal departments participate in the planning stage and when the mayor/reeve, Chief Administrative Officer, and councillors support hazard risk management. However this can be difficult for municipal governments because some municipal staff do not understand how their department could assist in the implementation of wildfire risk management measures (discussed further in section 8.4). Having multiple municipal departments involved in the implementation of wildfire risk management measures seemed to decrease the pressures placed solely on the *sparks* and the municipal fire department. This also allowed the development of new ideas regarding the implementation of wildfire risk management measures, resulting from a variety of backgrounds and training of municipal officials within each department. A collaborative approach is beneficial for the planning process, as identified by one municipal participant:

> ***Participant A:*** *"In fact, I think it's better from a development standpoint…There is better communication, as far as you know what we want from a fire protection standpoint, and what they need to know from a development standpoint."*
>
> ***- Planning Department***

This is also apparent in the study completed by Reams *et al.* (2005) who found that most United States fires managers are involved in collaborative planning with an average of four partners.

One participant from a planning department said that they felt there were other municipal departments more equipped to implement wildfire risk management measures compared to the planning department. This requires the *sparks* to communicate with other municipal officials and explain how their involvement could positively affect the implementation of wildfire risk management. Planning departments are able to assist their municipality by creating development plans (e.g. ensuring multiple access routes and road widths) identifying how land should be developed and creating municipal bylaws (e.g. requiring the use of fire resistant building materials) that lead to the protection of the municipality from a wildfire.

After the mayor/reeve, councillors and other department heads were informed about wildfires and the benefits of implementing wildfire risk management measures, each participating municipal government received some level of internal support. This would then lead to stage three.

7.3 Stage 3

During the third stage, participating municipal governments were simultaneously working through three related stages: 3A) collecting resources, 3B) updating their wildfire risk management proposal, and 3C) gaining external support for wildfire risk management measures.

7.3.1 Stage 3A: Collect Resources for Implementation

Resources included funding, time, personnel and equipment. Funding, both internal (e.g. municipal tax dollars) and external (e.g. provincial grants), was the first resource that was needed. Once funding is obtained, time was allocated, and finally personnel and equipment (e.g. heavy suppression equipment, water tankers and vegetation management equipment) were collected to implement wildfire risk management measures. All participating municipal governments were collecting resources (funding, time, personnel, and equipment) in order to implement wildfire risk management measures. However the resources that had been obtained varied in each participating municipality.

The majority of participants said that their municipality did not have enough internal and external funding to effectively implement proposed wildfire risk management measures. The lack of internal resources may be due to competition with other municipal activities (e.g. structural fire fighting, policing, parks and water) for tax dollars (discussed further in section 8.5).

7.3.2 Stage 3B: Update the Wildfire Proposal

Stage 3B involved the municipal governments updating the first draft of the wildfire risk management proposal created by the *sparks* in stage one (Figure 7.1). When updating the wildfire risk management proposal, municipal governments, especially those found within the Forest Protection Zone, gathered information about how to implement wildfire measures from the FireSmart Manual (Partners in Protection 2003), or asked Alberta Sustainable Resource Development for assistance in formulating and updating their plan. Some participating municipal governments also asked surrounding municipal governments for assistance if these municipal governments' had already completed wildfire risk management measures within their jurisdiction.

7.3.3 Stage 3C: Acknowledge External Support and Create an Awareness of Wildfire Risk Management Measures

Stage 3C involved gaining support from all parties that could be potentially affected by a wildfire (e.g. residents, environmental groups, businesses, and industries) (Figure 7.1). The steps were: 1) acknowledgement from municipal officials that they need external support from all potentially affected parties, 2) creating public awareness of local wildfire risks, and 3) gaining support from all potentially affected parties for wildfire risk management measures that could be implemented by the municipal government or by homeowners and stakeholders implementing wildfire mitigation and preparedness measures on their own properties. The majority of participating municipal governments were completing steps two and three, however only a few acknowledged and were gaining external support from all potentially affected parties.

Some municipal governments that did not acknowledge and gain external support (outside the municipal office) experienced setbacks when they tried to implement vegetation management. This resulted in the municipal governments halting their wildfire risk management activities that the public did not support. Other municipal governments indicated that residents could hinder wildfire risk management by remaining passive and not becoming involved in the wildfire implementation process:

> *"... We had some negative feedback in one of the areas we went working in... and there was a backlash from that part of the*

> *community. We hadn't [had negative feedback] in previous areas, but this one we got a backlash, and we realized that if we had communicated our… aims and intentions, [and] actually involved them, in particular this one community association, we could have smoothed [the concerns] out because when they saw the crews going in … they thought [the municipality was]… knocking [down their]… forest… And it was a pretty strong backlash… and we realized that involvement of the community where we work [is important and] we learned our lesson, that communication is an important element…"*
>
> ***- Fire Department***

A resident living in this area commented on his desire to see municipal governments improve their communication with their residents regarding the implementation of wildfire risk management, so that homeowner feedback could be provided about the wildfire risk management proposal, to the municipality:

> *"I think that municipalities [municipal governments] have the responsibility to involve the community that is directly affected by sharing the information and also getting input back from its members of the community, so that they can work together."*
>
> ***- Resident***

Acknowledgement from municipal officials that all potentially affected parties (e.g. residents, environmental groups, businesses, and industries) must be engaged in the planning and wildfire implementation process, lead to a greater acceptance of the municipal wildfire proposal from everyone in the municipality. A few municipal governments that had experienced setbacks expressed the need to (and their plan to), inform the public about implementing future wildfire risk management measures. Lang *et al.* (2006) concluded that for local government in the United States to effect change, municipal officials' needs to obtain public commitment, identifying that wildfires are an important issue that need joint effort. The importance of having public commitment for the municipal implementation of wildfire risk management measures has also been identified by Westhaver (undated), and also Renn *et al.* (1991) in their study of emergency management. Alberta Municipal Affairs and Housing (2005) have also concluded that municipal governments, who view public input as an added demand will spend more time resolving issues than municipalities where public input was sought, because citizens will become more assertive in their effort to be heard.

The second and third steps required communication with all potentially affected parties about wildfires, the local risk, and wildfire preventative measures that could be implemented on public and private land to reduce this risk. McCaffrey (2004a) states that it is necessary for individuals to access information to increase their awareness of a hazard, its potential consequences, and what preventative measures can be implemented to reduce the threat. Chapter six identified the most frequent techniques (pamphlets, open houses, and newsletters/bill stuffers) used by participating municipal governments to communicate with their residents. Chapter eight also discusses the need for communication with all potentially affected parties within the municipality, specifically residents, to educate them, as well as hear their views.

Fifteen municipal governments communicated with residents about measures that residents could implement on their own properties. In two-way communication the public could also express concerns about the implementation process that had not been considered by the municipal government. However, the most frequently used wildfire communication techniques used by the participating municipal governments were one-way.

7.4 Stage 4: Communicate Proposal with Residents, Environmental Groups, Businesses and Industries

Stage four involved the municipal governments communicating with all potentially affected parties (e.g. residents, environmental groups, businesses, and industries) and the provincial government (if the municipality was found inside the Forest Protection Zone) about the municipal wildfire risk management proposal, and engaging them in the planning of wildfire risk management measures (Figure 7.1). Recently, there has been a shift from 'if' the public should participate in hazard risk management to 'how' the public should be included in the process (Pearce 2003). There were two steps in this stage: 1) communicating with all involved parties about the wildfire risk management proposal, and 2) seeking support and acceptance for the wildfire management proposal to create a formal plan.

The first step is important because this provides all potentially affected parties (e.g. residents, environmental groups, businesses and industries) with a chance to voice their questions and concerns and allow them to feel included in the decision making process (Renn *et al.* 1991). However, only a few participating municipal governments communicated and received input from these potentially affected parties about the wildfire risk management proposal. All municipal governments inside the Forest Protection Zone gained input from the provincial government. When provincial government was involved they brought an increased number of industries into the process. Those municipal governments that did not communicate their proposed wildfire risk management plan with all potentially affected parties and the provincial government, were more likely to experience public resistance hindering the implementation of the wildfire risk management plan.

Several participating municipal governments communicated the municipal wildfire risk management proposal with residents, environmental groups, businesses, industries and provincial government, usually by holding open houses. Open house attendees could then ask questions and propose alternative ways to implement wildfire risk management measures. This two-way communication technique increased support and trust from those individuals that attended the meetings, allowing the municipal government to effectively implement wildfire risk management measures (see further discussion in section 6.3.2) (Agrawal and Monroe 2006, Toman and Shindler 2006). Therefore, the participating municipal governments that included this stage in their implementation of wildfire measures had increased success of implementing wildfire risk management measures with in their municipality. Once this step was completed, then municipal officials made the proposal an official municipal wildfire risk management plan.

The municipal officials who were frequently involved in this stage of the process were the fire chief/deputy fire chief, chief administrators and councillors. These municipal officials were communicating with the potentially affected parties, usually through open houses, about the municipal government's proposed wildfire risk management plan, the wildfire risk management measures that were being considered for implementation, where and when the measures would be implemented and how the measures would be completed. This would allow municipal officials who had the most expertise in a wildfire risk management area to answer the questions posed by these individuals. The planning and parks departments sometimes participated in these open houses if the proposed wildfire measures were related to land-use or vegetation management.

If municipal officials did not acknowledge that public support was needed during the implementation of wildfire risk management (stage 3C) the municipal government was not likely to progress to and implement stage four. Even if municipal officials did acknowledge that public support was needed, open-houses were usually met with low resident attendance. As a result, when the municipal government began to complete the wildfire risk management measures within the municipality (e.g. vegetation management), public outcry may have occurred causing the municipal government to halt work.

Neal and Younis (2006) who examined the management of the BSE crisis in the United Kingdom, similarly concluded that the absence of coordination and communication between municipal officials and residents, before and during the policy decision making process could result in a failure of the process implementation. As residents want to become involved in the process, municipal officials need to include residents to reduce the potential conflict.

7.5 Stage 5: Implement Municipal Wildfire Risk Management Measures

Stage five involves the implementation of the wildfire risk management measures (Figure 7.1). Wildfire risk management measures implemented were emergency preparedness plans, infrastructure measures, communication, wildfire hazard assessments, vegetation management, land-use planning, and structural measures. All participating municipal governments were completing at least one wildfire risk management measures within their municipality (see table 6.1). This fifth stage in the wildfire implementation process was a relatively easy stage to complete if the municipal government had effectively completed the previous four stages. The municipal fire department, and Directors of Disaster Services and Directors of Emergency Services were always involved in this stage of the wildfire implementation process, while the planning and parks departments were often involved. The planning department implemented land-use planning measures, infrastructure measures and distributing information about vegetation management and structural measures to homeowners, builders, and developers. The fire department and parks department completed wildfire hazard assessments and vegetation management on both municipal and private lands. They could also determine structural measures to be implemented on government buildings and provide suggestions to homeowners and companies about structural measures that they could implement on their buildings. This stage also involved the fire department communicating with residents about wildfires and risk management measures that were being completed on municipal land and wildfire measures that could be completed on homeowner property.

Difficulties did occur during this stage for some municipal governments where their planning department was not involved because they were not able to implement infrastructure measures and land-use planning measures.

7.6 Stage 6: Update, Assess and Maintain the Implemented Wildfire Risk Management Measures

The final stage in this process was the annual updating, re-assessing and maintaining the already implemented wildfire risk management measures (Figure 7.1). For example, the majority of participating municipal governments were examining and updating their emergency preparedness plan every three to four years. The majority of participating municipal governments had recently completed some wildfire risk management measures. These municipal governments stated that they had plans to finish up some already planned wildfire risk management measures and then return to the areas where they had completed vegetation management to reassess and maintain these areas, as vegetation will continue to grow creating another high-hazard fuel area (Stephen & Collins 2007). The participating municipal governments that had completed wildfire management plans in these designated areas returned to step two in stage one (developing a wildfire management proposal) (see Figure 7.1), so that they could manage and reduce the wildfire threat level in other high-risk areas within the municipality.

7.7 Chapter Summary

This six-stage process for implementing municipal wildfire risk management measures (Figure 7.1) is complex. This process requires extensive coordination, communication and participation between municipal governments, higher government and all potentially affected parties including residents, environmental groups, businesses, and industries. The participating municipal governments that worked through each of these six-stages had increased success in preparing their municipality for a wildfire, while several participating municipal governments missed one or multiple stages and as a result experienced setbacks in their implementation of wildfire risk management measures. The municipal wildfire implementation process must start with a dedicated and knowledgeable *spark*. Acknowledgement of the six-stage process and progression through each stage is necessary for successful implementation.

CHAPTER EIGHT

Results & Discussion: The Influencing Factors

The results of the phase one telephone interviews and phase two in-person interviews indicated that there were six main factors that influenced the 18 Alberta municipal governments' implementation of wildfire risk management measures in their jurisdiction. These factors were: 1) wildfire experience, 2) perceptions of wildfire risk, 3) communication of wildfire information, 4) support from municipal officials and the public, 5) access to resources, and 6) municipal geography. These are discusses below.

8.1 Wildfire Experience

Participants' past personal experience with wildfires appeared to have an influence on their municipal governments' implementation of wildfire risk management measures. Most of the 37 participants had directly experienced a wildfire as a resident, first responder, or assisting in suppressing a wildfire either in their current municipality or in a previous job. All except one fire chief/deputy fire chief, and chief administrator (councillors, Chief Administrative Officers, Director of Disaster Services, and Directors of Emergency Services) had previous wildfire experience. All except one participating mayor/reeve had experience with wildfires, but only two of the seven participating planners had experienced a wildfire. This experience helped the majority of municipal participants become aware of the extent of damage that could be caused by a wildfire and the need to implement wildfire risk management measures.

Participants from the fire department stated that they had gained their knowledge of wildfires during their time working in municipal fire departments and working with Alberta Sustainable Resource Development in fire suppression and containment. These participants had worked within municipal fire departments from six months to approximately forty years. As a result of this experience, municipal fire department participants realized that wildfires are dynamic and unpredictable:

> *"All of my [wildfire] experiences have been dealing with different weather conditions, different ground cover, [and] different terrain. [Each wildfire is] a new experience, so they have all increased my awareness and perception of what a wildfire can do."*
>
> ***- Fire Department***

Chief administrators (councillors, Chief Administrative Officers, Director of Disaster Services, and Directors of Emergency Services) had gained their knowledge of wildfires through working with their fire departments, in previous jobs, as well as from personal experience as a resident. The mayor/reeves and planners who had experienced a wildfire gained it either as residents or as council members during a local wildfire.

The lack of experience of some municipal officials, particularly planners, hindered the effective implementation of wildfire measures, because they had never given any thought to their municipality being affected by a wildfire:

> *"I have never thought about that [being affected by a wildfire]"*
>
> ***- Planner***

The majority of these inexperienced participants were found within larger urban centers. If these municipal officials had experienced a wildfire they may see a greater need, similar to the *sparks*, to implement wildfire risk management within their municipality.

A few municipal participants, predominantly planners, identified that they personally felt a lack of experience to help their municipal government implement wildfire risk management measures. This was a result of their lack of direct experience with wildfires. One participant commented on their lack of experience when helping the municipal government communicate with residents about wildfire risk management measures that could be implemented on private properties:

> *"I am struggling a little bit with that [implementing wildfire management measures] because coming to this County was my*

> *first encounter working so closely and so consciously towards emergency plans and fire hazards... it wasn't part of my training when I became a planner, and I've been in the planning profession for [a few] years. The previous municipality where I worked never put that [wildfires] as a high priority. So for me coming to this County encountering this awareness and safety measures as a priority, I personally feel my knowledge is a little bit inadequate, to assist the public and ensuring that our benchmark for development stays high... Luckily I have fantastic fire chief, to work with. He's just a phone call away and always comes to a meeting when I ask him to be in attendance... But it [my knowledge] is growing with the exposure that I am getting."*
>
> ***- Planner***

Some participating municipal governments had found problems keeping personnel with wildfire experience within their municipality, because those with expertise were reaching retirement age or moving to another job outside of the municipality:

> *"We have a very transient population... so keeping experienced people in positions is somewhat of a problem... at a certain time we can have all the expertise in the world, but three years later we may be lacking some of that expertise because it [they] moves on."*
>
> ***- Mayor/Reeve***

This study finds that experience is an important factor influencing the implementation of wildfire risk management measures by municipal governments in Alberta, which has also been identified by Jakes *et al.* (2003), as human capital influencing community wildfire preparedness. New individuals brought in to the municipality to replace previously experienced municipal officials may lack the understanding and need to prepare the municipality for a wildfire thereby increasing the risk ~~their~~ municipality faces. Resolution of this would require resources (e.g. funding, time, personnel) to be expended by the municipal government to educate new municipal officials, who may not remain in the municipality.

Wildfire experience assisted all participating municipal governments during the initial identification of a potential wildfire problem (stage one) because the municipal officials who had past experience were the individuals who believe there to be a high risk. Experience also influenced updating the wildfire proposal (stage 3B), communicating with all potentially affected parties (stage four), and the implementation of wildfire risk management measures on municipal lands (stage five). This was because those individuals with experience were able to bring their personal knowledge about how best to implement wildfire risk management measures, communicate which wildfire measures should be implemented, and assist to identify high wildfire hazard areas, which municipal officials without experience would not have been able to do. The role of experience on risk perception and the desire to mitigate risk has also been identified by Tierney *et al.* (2001), who conclude that individuals who have experienced a natural hazard event had increased knowledge about the hazard and how to prepare, compared to individuals who have not experienced a hazardous event. Municipal participants with experience also assisted their municipal government to communicate with council and other departments (stage two), and the public (stage 3C), about wildfires and the wildfire risk management measures. These municipal participants were able to provide first hand descriptions of what could happen to their municipality if they had or had not completed wildfire risk management measures and a wildfire occurred.

8.2 Perceptions of Wildfire Risk

Perceptions of wildfire risk are important as an individual who deems the risk to be low will less likely implement wildfire risk management measures and support these measures to reduce exposure (McCaffrey 2004a). All participants from the municipal fire departments and a few Directors of Disaster Services and Directors of Emergency Services felt that their municipality was at high wildfire risk. Participants' perceptions of wildfires risk appeared to be related to their training and experience, as many, but not all of those participants had previous experience fighting wildfires. All fire chiefs/deputy fire chiefs, chief administrators and a few planners and mayor/reeves felt that the impacts of wildfires were possible to control by implementing wildfire risk management measures, although in all cases this depended on the size of the fire:

> *"Up to a certain level [of municipal preparedness], yes... A large one [wildfire], no. I don't think anybody really can be all that prepared for it [a large wildfire] though."*
>
> ***- Fire Department***

Participants in municipal districts and counties tended to perceive a higher wildfire risk than those in cities and towns. This was because participating municipal districts and counties tended to be heavily vegetated, resulting in the need for these municipal governments to manage these large areas of potential wildfire fuel:

> *"We live in a high forest area and [wildfire is] part of our environment. [Wildfires] It's kind of... in our faces and in our bubbles and therefore its part of our lives. It's not remote and distant, and happening elsewhere."*
>
> ***- Planner***

Some participants perceived a high risk because their municipal government had done little to implement wildfire risk management measures:

> *"We started a [wildfire] group, and we've had meetings every month. We've identified the problems, but we haven't dealt with them. It's just an ongoing... No, we're not, we're not prepared, at all."*
>
> ***- Chief Administrator***

Municipal participants also perceived a higher risk if local residents were not prepared for and had a low level of knowledge about wildfire. Municipal participants felt that some of their residents had a good understanding of wildfires and were prepared, while others did not:

> *"Without actual having done a survey of all residents to find out what their understanding is, I would have to say unsure on that one. I know there's a lot of people out there who are very well aware of it, and there's also a lot of people who just don't think about it."*
>
> ***- Fire Department***

The majority of municipal governments had not gathered information about the wildfire knowledge of residents. Therefore, perception and presumption played a large role in the municipal governments' understanding of their residents' knowledge about wildfires and how prepared homeowners were for wildfires. These views were based on what wildfire mitigation and preparedness measures residents appeared to be completing on their properties, as well as informal conversations with some residents:

> *"...I suspect that a lot of people don't give it [wildfire management measures] a lot of thought by the way they have their yards, and their acreages, and the fact that they're not kind of keeping the fire load down, and things like that... I get the impression [residents feel] that 'It isn't going to happen to us', so they probably aren't as aware of it as they should be..."*
>
> ***- Fire Department***

Public perception of risk could affect the work of local government officials, because an informed public could be a major ally for municipal officials (Drabek & Hoetmer 1991).

Participants' wildfire risk perceptions influenced the initial identification of a potential wildfire problem (stage one), gaining internal support for wildfire risk management measures (stage two), gaining support for municipal wildfire management (stage 3C), and communicating the wildfire management proposal with all potentially affected parties (e.g. residents, environmental groups, businesses and industries) (stage four). In stage one, high wildfire risk perceptions lead the *sparks* to want to implement wildfire risk management measures to reduce this potential destruction from occurring in their municipality. High risk perceptions leading to the desire of municipal officials to implement hazard risk measures has also been identified by Tierney *et al.* (2001) and Mulilis and Duvel (1995). In stage two, the municipal officials with a high risk perception communicated their concerns about wildfires to other municipal officials (e.g. the mayor/reeve, planners) to provide them with information to encourage support and participation for the implementation of wildfire risk management measures. This was also similar for stage 3C when the *sparks* and municipal officials communicated with all potentially affected individuals (residents, environmental groups, businesses and industries) about wildfires and the mitigation and preparedness measures that could be implemented throughout the municipality and on private property. Influencing perceptions about wildfires and identifying the need to implement wildfire risk management measures was important to encourage municipal officials and the public to play a more active role in the implementation of wildfire risk management measures.

8.3 Communication

Communication or the lack of communication was an important factor influencing the effective implementation of wildfire risk management measures in the participating municipal governments. Communication is critical during every stage of the process, although whom the communication is directed to varied. Failure to carry out effective communication caused the majority of setbacks and struggles in the participating municipalities because communication was often not carried out throughout the entire implementation process.

The majority of participating municipal governments were using one-way communication techniques because of limited municipal resources (e.g. time, funding, and personnel). The majority of *sparks* were communicating to the mayor/reeve, councillors, and other department heads, while external communication with residents, environmental groups, businesses and industries was completed less often (see section 6.3). All municipal governments inside the

Forest Protection Zone were communicating with Alberta Sustainable Resource Development.

Communication influenced all stages of the implementation process. In stage one, *sparks* communicate with others municipal officials to determine if they were concerned about wildfires. This communication was completed through informal two-way discussion. *Sparks* also communicated with the provincial government in stage one to obtain assistance for the development of the municipal wildfire management proposal.

Sparks then communicate to all municipal officials about the need for the municipal government to implement wildfire risk management measures and the need for their participation in the implementation process (stage two). Communication was important for these initially aware *sparks* to effectively communicate their messages. Two-way communication techniques were used for this stage to allow for discussion between municipal officials and increase the municipal awareness of why wildfire risk management measures are needed. Communication was carried out during stage 3A as the *sparks* and involved municipal departments asked for resources to implement the wildfire risk management measures. Both one-way and two-way communication techniques were used in this stage, as written letters and formal and informal discussions occurred about the availability and access to resources. In stage 3B, two-way communication was carried out with council, municipal departments and the provincial government to create the updated wildfire management proposal.

Communication (both one-way and two-way techniques) was essential in stage 3C when the municipal governments communicated with all potentially affected individuals (e.g. residents, environmental groups, businesses, and industries) about wildfires and the need for the municipal government and these individuals to implement wildfire risk management measures. One-way communication was used during this stage to inform these individuals about wildfires, while two-way communication allowed for more complex and potentially controversial topics to be discussed. Two-way communication was beneficial during stage four when the municipal government communicated to these individuals again about the wildfire management proposal, as these individuals were more responsive. Slovic (2000) indicates that risk communication and risk management will fail unless two-way communication is established between the public and officials. Plevel (1996) also identified the need to include all participants in the planning process.

Stage four involved predominately two-way communication between the municipal government and all potentially affected parties (e.g. residents, environmental groups, businesses, industries), and the provincial government. Participating municipal governments would communicate their updated wildfire management proposal with these individuals and obtain feedback on their proposal. Feedback was important so that concerns and questions about the proposal can be answered and alternative means of implementing wildfire risk management measures could be discussed. Feedback was also important because this is the last stage before the municipal government began implementing the wildfire risk management measures described in the plan.

In stage five, communication was completed during the implementation stage by some municipal governments to remind residents living in high risk areas that vegetation management will occur and to keep residents abreast of the municipal government's progress. Communication occurred during these stages to inform residents, builders and developers about guideline or regulations they needed to follow regarding planning measures, and how to complete wildfire hazard assessments.

Finally, communication was completed during stage six, because updating, re-assessing and maintaining wildfire risk management measures was required, particularly for vegetation management. Municipal officials and the public had to be kept up to date if further implementation was needed. Communication was also used during this stage to keep the public aware of wildfires and the need to implement wildfire risk management measures, new planning regulations, and reassessing wildfire hazard assessments.

Numerous participating municipal governments commented that they continually distributed information about wildfires and preventative measures that could be implemented by residents, however the municipal governments were not aware of how much of this information was being retained and understood by members of the public. Therefore, communication was important to determine a residents' understanding so that they were not saturated with information and begin to disregard it, or are provided with information that they do not understand (Monroe & Nelson 2004). The few participating municipal governments that were collecting information about residents' knowledge of wildfires and wildfire mitigation and preparedness measures were collecting this information either from an external agency hired by the municipal government or was informally collected by the municipal participants themselves:

> *"I have [collected information from residents], but just kind of personally. It's not recorded or written down anywhere."*
>
> ***- Chief Administrator***

However, the municipal participants who had informally obtained information about residents' views identified that this approach did not ensure that the municipal government was collecting the views of all residents in the municipality:

> *"[We have collected data] only informally during the various get-togethers that we have. The pancake breakfasts... talking to people out in the street type of activity, so it's really tough. You don't know if you've got just a specialized segment of the population you're talking to, or if you've got everybody, or not."*
>
> ***- Fire Department***

The amount of communication to residents about wildfire and wildfire mitigation and preparedness measures raised concerns about municipal liability for a few participating municipal governments. There were two separate municipal liability concerns that were expressed during this study. A few municipal governments expressed concern over their distribution of wildfire information within their municipality to residents. This concern lead these municipal governments to feel that if they communicated with their residents about wildfires, and the municipal government completed no other risk management measures, they could possibly be held liable if their residents lost their property or lives in a wildfire. This could affect a municipal government's desire to communicate the potential wildfire threat to their public as they may not have the resources to complete any other wildfire risk management measures to increase protection for their municipality from a wildfire. In the words of one participant:

> *"If you recognize a problem, and don't do more about it, you may be liable."*
>
> ***- Planner***

Although Plevel (1997) identified liability as a factor affecting state and local governments in the United States, the majority of participating municipal governments in this study were unconcerned about potential liability, because they felt that they needed to increase awareness and therefore decrease the chance of people losing property and life during a wildfire.

The second liability concern for some participating municipal governments resulted from the influx of people moving into these municipalities. The municipal officials were concerned about their ability to reach all homeowners in the municipality because people were continually moving in and out of the area. These officials expressed concerns that if they could not reach each resident and inform them about wildfires and measures that can be implemented by residents, and a wildfire occurred, the municipality could be held liable:

> *"Because of the rapid growth in our communities, I don't think we can keep up with the informing, so I think there is a liability there. We do try our best, but with the numbers of people moving into the municipality it is getting tougher and tougher to make people aware."*
>
> ***- Mayor/Reeve***

This concern over liability resulted from a municipal government's lack of resources, specifically time and personnel, to educate the growing municipal populations.

8.4 Support

Participating municipal governments received internal support from all fire chiefs/deputy fire chiefs and chief administrators, and the majority of planners and council (the mayor/reeve and councillors) for the implementation of municipal wildfire risk management measures. External support was provided in some cases by the provincial government and industry, while perceived resident support was mixed. Support includes interest, approval and help provided to an organization, group or individual (Thompson 1996). Therefore support in the context of municipal wildfire risk management can be provided to *sparks* from municipal officials, residents, environmental groups, businesses, industries, and the provincial government in the form of assistance, interest and involvement in the implementation of wildfire risk management.

All fire chiefs/deputy fire chiefs and chief administrative participants supported the implementation of wildfire risk management measures. This support resulted from these municipal officials having previous experience, and high risk perceptions. Several municipal planners supported the implementation of wildfire risk management measures, which lead to their involvement in the process. Councils in the majority of participating municipalities supported their municipal government's implementation of wildfire risk management measures. Council support seemed to reflect their understanding of wildfires and need for wildfire risk management funding:

> *"...The fact that the Council's... ever since I've been here have been very proactive, and supportive of the initiatives towards it [implementing wildfire risk management measures]. And, you know, if you go to them with a valid reason [for implementing], you know, they don't turn it down."*
>
> ***- Fire Department***

However, some municipal councils were reportedly less supportive when the municipal governments tried to implement wildfire risk management measures. This appears to be due to changes in membership of the municipal council:

> *"... We have a... fairly new Council and I don't think they have been exposed to [the wildfire threat and our wildfire program]. Our older Council did... Their focus as a new Council has to do with development."*
>
> ***- Fire Department***

Each new council that is elected into municipal office may have differing opinions about municipal priorities, which could affect their support, or council could be supportive of the implementation of wildfire risk management measures but allocate funding to more popular municipal priorities. Municipal participants said that those council members who supported the implementation of wildfire risk management measures usually had a higher risk perception resulting from their previous experience with wildfires.

Resident support for the implementation of wildfire risk management measures was perceived by the majority of municipal officials to vary over time. One participant commented on their perception of the changing public support found within their municipality:

> *"Public support is hot and cold. It's here today, gone tomorrow. It's back and forth. It depends on the [wildfire] events. Again, if we have some serious [wildfire] events in town they're right behind the fire department... and then if there's the series of... basically low call months... then we won't get the support that we normally do."*
>
> ***- Fire Department***

Another participant said that public support was mixed, however if the municipal government decided to legislate any wildfire risk management measures (e.g. land-use planning and structural measures), they felt that people would not support the regulations:

> *"I would say it's been sort of in the middle. It hasn't come up as overly supportive, but it also hasn't been criticized. It's just there, because it hasn't gone that next step to become regulatory. To put those sorts of regulations in place, would limit people..."*
>
> ***- Planner***

Scanlon (1991) concluded that for general hazard management, government cannot effectively implement hazard risk management measures without the support and trust from the public. Therefore, perceived low support from residents hindered a municipal government's ability to implement wildfire risk management measures. McDaniel (undated) concludes that strong partnerships and public support are required for the creation of more resilient and comprehensive management plans, and without these partnerships and support there is an increased chance for conflict to occur which can delay or prevent the implementation process. Reams *et al.* (2005) found that the public apathy and residents' resistance to implementation of vegetation management measures were two factors that hindered state and county level governments' implementation of wildfire risk management measures.

Only a few municipal governments were directly communicating with industries, because most industries were located on provincial and federal lands and they were therefore working with these higher levels of government. Support was provided to some municipal governments from industries in the form of personnel and equipment to complete vegetation management on municipal lands. Industries (e.g. forestry, and oil and gas) that had provided support to municipal governments and were implementing wildfire risk management measures on their properties appeared to do so because they were aware that they could lose costly equipment and potentially their livelihood in the event of a wildfire. Support was also provided by industries as many of the municipal volunteer fire fighters worked full time for industry:

> *"... Industry has been very good to us as a department, as far as allowing workers time off [for] training... They have been very supportive in that [way]"*

- Fire Department

However, some municipal participants commented that support from a few industries, particular those that crossed their jurisdiction (e.g. the railroad) rather than being located on municipal government land were less supportive, and were a cause of wildfire ignition which spread to municipal land:

> *"I would like to say we are a small service, but we are pretty busy with fire and rescue. Grass fires are a big part of our business in the springtime, [*pause*] and [Industry A] is one of our biggest customers... [Industry A] no longer burns their right of ways and we have seen an increase in wildfires along their tracks... years ago they use to burn many areas along their right-of-ways... and we never had these issues in responding to brush fires along the rail... [this concern is recent] probably in the last 5-10 years."*
>
> ***- Fire Department***

Support from the provincial government helped municipal governments within the Forest Protection Zone implement wildfire risk management. Alberta Sustainable Resource Development has full time personnel dedicated to communication and public relations, and their role is to provide public information about wildfires and how municipal governments and residents can protect themselves and their property, as well as prevent initial ignition of wildfires. Participants from one municipality located inside the Forest Protection Zone commented that provincial government support was helping their municipal government to communicate about wildfires to their residents:

> **Participant C:** *"... Because Forestry [the provincial government] does have a dedicated communication/public relation's person, and... they're... initiating a lot of them [open houses], and then when we can go, we'll provide manpower or support at their functions. But really, they're the ones heading... that charge, just because they have the resources."*
>
> **Participant B:** *"Yeah, it's a full time staff person [in the provincial government], who is... the... key in all of that. It's really tough to*

> *do [for us]... we have so many other priorities... Forestry deals with just Forestry issues, more or less. We deal with highway safety issues, structural safety issues, fire prevention like as far as kids playing with matches, and all of that kind of thing, that we have to deal with... We try and incorporate it where we can, but it's... pretty tough without a dedicated [municipal] person doing that work."*
>
> **- Fire Department**

A few fire chiefs/deputy fire chiefs and chief administrators inside the Forest Protection Zone obtained support by having provincial government officials speak to their municipal council about the need to undertake wildfire risk management activities in their municipality:

> *"Usually what helps most is the Sustainable Resource Development folks talking to the council, and going through with them the needs, and the issues that they have to deal with, and what they are looking for in terms of support, and mutual aid, and that sort of thing."*
>
> **- Fire Department**

However, support from Alberta Sustainable Resource Development varied across the province. Several municipal participants outside the Forest Protection Zone said that they would like to receive the same support from Alberta Sustainable Resource Development as municipal governments inside this zone:

> *"I noticed that right way, that there is no presence at all, of Sustainable Resource Development in the 'white zone' [outside the Forest Protection Zone]. And it would be cool if they [the provincial government] could design something that was specifically for the 'white zone' to assist municipalities who are on their own... If you are in the 'green zone' [inside the Forest Protection Zone] the province is overboard in terms of what they provide municipalities with, in their support of wildfires suppression and education. But if you are in the 'white zone' it's*

> *kind of like you are left on your own. I would just like to say that because if they want us to help the landowners understand that, it would sure be nice to have something that was designed for the 'white zone'.*
>
> **- Chief Administrator**

This participant also felt that if provincial support were provided province wide, this would help educate transient populations:

> *"People move all the time, and to me it would make sense for the province to try to invest in... maybe a water downed version of that same program for communities in the 'white zone'. So that when they [residents] do move to the 'green areas' which they do... that would certainly help the [municipality] ... in the 'white zone' [who] are... left on their own to fend for themselves... I know we don't have forest fire potential out here, but like we said before there are potential for lives loss, building loss from a wildfire, either through brush or through grassland. And that would be my biggest thing, and I think that communities such as ours still need to plan for that risk..."*
>
> **- Chief Administrator**

Internal support influenced the acceptance of the wildfire management proposal (stage two), gaining access to resources (stage 3A), updating the first draft of the wildfire management proposal (stage 3B), gaining involvement from potentially affected individuals (stage 3C), and communicating the wildfire management proposal with all potentially affected individuals. Both internal and external support influenced the ability of participating municipal governments to effectively implement wildfire risk management measures because without support municipal governments did not receive acceptance and resources to complete the project. Support from council was obtained in stage two, because they allocate funding and resources for the municipal implementation of wildfire risk management measures. If council did not provide support then the wildfire measures would most likely not be implemented within the municipality. Support from municipal departments, industry and the provincial government was needed during stage 3A and 3B when municipal governments collected resources and updating the first draft of the wildfire management proposal. Support was required during stages 3C and four, from residents, environmental groups, businesses, and industries. This allowed the municipal government to implement wildfire risk management measures with minimal resistance and setbacks.

8.5 Resources for Implementing Wildfire Risk Management Measures

Resources such as funding, time, equipment, and personnel (including training and wildfire education for these individuals) influenced municipal governments' ability to implement wildfire risk management measures. These resources can be divided into two main categories: internal resources (resources supplied from within the municipal government), and external resources (resources supplied by agencies found outside the municipal government). Successful municipal governments had access to or were able to obtain both internal and external resources needed to implement wildfire risk management measures. However, representatives from most participating municipal governments indicated that they did not have sufficient funding from external sources, nor did they have sufficient internal funding sources to implement wildfire risk management measures. Many participating municipal governments were applying for external funding from the provincial government (Alberta Sustainable Resource Development) in the form of a grant from the FireSmart Community Grant Program. At the time of this study, this program was only available for municipal governments found inside the Forest Protection Zone (two-thirds of participating municipal governments). Those participating municipal governments that were not eligible for this grant included cities, towns and municipal districts/counties located in the Parkland and Grassland bioregions (Figure 3.1), and were surrounded by predominantly deciduous trees, brush and fescue grasses. All participating municipal governments that were eligible to receive this grant said that they were aware of the grant program, and the majority had applied for this grant at least once since the program was established in 2005. One participant whose municipal government had applied for and received this grant in 2005 commented on the increasing popularity of the grant program, and future difficulties in obtaining this funding:

> *"The first year that they had the FireSmart money, we received the grant because it wasn't a popular program. It's gained a lot of popularity, so there's more competition for the funding dollars, and I think as we've been FireSmarting every year, and applying for grant money, it's gonna be a little harder for us to get money. It will go more to first time communities. I don't know if it's assessed on a risk management level."*
>
> ***- Planner***

Only a few eligible municipal governments had not applied for this potential source of funding but were planning to in the future. Most participating municipal governments that had applied for this grant were successful. Therefore, the majority of participants found inside the Forest Protection Zone stated that they were using a combination of internal and external funding:

> *"[Our municipality is using the] Alberta Sustainable Resource Development [grant] and municipal dollars [to implement wildfire management measures]... We have put some dollars in as well. It's not been a total burden on the municipality itself."*
>
> ***- Fire Department***

A funding program has also been available to municipal governments outside the Forest Protection Zone since 2003 under the Municipal Wildfire Assistance Program of Alberta Municipal Affairs and Housing. However, none of the participating municipal governments outside the Forest Protection Zone were aware of this program. Therefore municipal governments outside the Forest Protection Zone were only using internal funding obtained from council and their own departments to implement wildfire risk management measures. This internal funding was obtained by making a proposal to council. If council agreed with the plan and understood the importance of protecting their municipality from the threat of a wildfire, then internal municipal funding had a good chance of being provided.

However, municipal governments that relied only on internal funding struggled to implement wildfire risk management measures because they competed with other municipal activities (e.g. structural fire fighting, policing, parks and water) for municipal dollars.

> *"Budget constraints, of course it is always a problem... Municipal tax dollars only go so far and there are many other projects [in the municipality] that require funding. So you have to prioritize."*
>
> ***- Fire Department***

McCaffrey (2004a), Plevel (1997, 1996), and Davis (1990), have also identified that wildfire risk management measures compete with other municipal concerns and programs (e.g. reducing drug use, fixing potholes, protecting environmental sensitivity, maintaining a buildings aesthetic value, protection of endangered species) for tax dollars. Some local governments that are dealing with these other municipal problems have been identified as unwilling to put a high priority on wildfire risk management measures because the probability of a wildfire occurrence is relatively low (Davis 1990). A few municipal government participants said that if they could 'sell' the implementation of wildfire risk management measures with other municipal activities (e.g. improving sight-lines for bears, reduce mosquito and pine beetle habitat) that could be completed simultaneously, there was an increased chance that they could obtain more internal funding from their municipal council to complete wildfire risk management measures.

When financial resources were obtained, time and personnel could then be gathered by the municipal government to implement wildfire risk management measures. The fire department, parks department, emergency services department and the planning department may supply personnel to implement wildfire risk management measures. However, the majority of representatives from the participating municipal governments stated that they did not have enough time to effectively communicate to their public about wildfires and risk management measures that can be implemented. This concern appeared during stages 3C, four, five, and six when the municipal government communicated with all potentially affected individuals within the municipality.

Only five participating municipal governments stated that they had specifically trained mitigation professionals whose job it was to ensure that a municipality was prepared for a wildfire. These individuals were found within municipalities that were isolated from other populated areas as well as some that had experienced a threat from a significant wildfire. Similarly, Margerum (2001) concluded that in the United States and Australia, "governments indicated that they did not have adequate staff or staff time to send them to meetings, fund projects, or allocate them to joint projects" about emergency management (pg. 424). Thus this lack of sufficient funding in Alberta appears to be consistent with that in other countries.

Volunteers staffed the majority of fire departments included in this study, and all fire chiefs and deputy fire chiefs identified a lack of time and personnel in their department to implement wildfire risk management measures, because there were either few or no paid staff, and volunteers were juggling other tasks, jobs and family life. In some municipal districts and counties, the fire chief and deputy fire chief were volunteers, and they were excluded from discussions with other municipal officials and provincial representatives about implementing wildfire risk management measures because their office was located in another village or hamlet and due to time constraints resulting from competing job description tasks.

Some municipal fire chiefs/deputy fire chiefs in rural municipalities expressed concern about the potential decrease in their number of municipal firefighters as a result of their current firefighters aging and a lack of younger firefighters replacing them:

> ***Respondent A:*** *"... as our departments age, I am concerned about the level of ... volunteer support that we are going to get from the communities."*
>
> ***- Fire Department***

Similarly, McLennan and Birch (2005) who studied Australia's volunteer fire departments, found that their fire service has experienced a significant decrease over the last several decades in the number of available firefighters because as the fire fighter population is aging, there was a decreasing number of younger new fire fighters replacing them. Born and Stocks (2006) have also identified this shift in firefighter demographics in Canada, and conclude that with the retirement of this large number of firefighters, extensive knowledge and technical expertise regarding wildfire risk management measures and how to effectively implement the measures will be lost.

Another participant said that their volunteer status meant that they were less outspoken about the need for wildfire risk management in their municipality:

> *"I know if we were a full time department... I wouldn't go to council with [just] suggestions. I would go to council with... be more demanding, I guess is what it would be, and say these things [wildfire risk management measures] have to be done..."*
>
> ***- Fire Department***

Volunteer fire chiefs and deputy fire chiefs who were vocal advocates about the need to implement wildfire risk management measures in their municipality were more effective in initiating wildfire measures over municipal officials who were less outspoken.

With respect to planning for a wildfire, half of the 18 participating municipal governments identified that they had enough wildfire management equipment (e.g. water transportation vehicles and heavy suppression equipment such as bulldozers). Heavy suppression equipment was usually collected from the provincial government or area industries with the help of mutual aid agreements.

The collection of resources occurs in stage 3A. Without resources, a municipal government could not effectively implement wildfire risk management measures. Several participating municipal governments had plans to implement wildfire risk management measures, however did not have the personnel or time to complete the measures at the time of the interviews:

> *"...If there was more manpower, then there would probably be more time to get at it. But, you know, there's only 2 of us on the fire side of things here, looking after [thousands of] people and [a vast area of land]... There just isn't time to deal with it the way it should be dealt with."*
>
> **- Fire Department**

> *"... I don't have the wherewithal to get my members involved in going out, and initiating programs, doing the advising, doing the follow up. I can't do that. I just don't have enough people where I can do that, at all..."*
>
> **- Fire Department**

Ensuring resources (e.g. funding, personnel and equipment) were available not only for the implementation of wildfire risk management measures but also for quick fire suppression were also needed by the participating municipal governments as part of the planning process. External funding collected from residents, businesses and industries was also used to buy and build equipment to have on hand if a wildfire threatened the municipality. For example, in one participating municipality the fire department received donations from department staff, residents and businesses to build and have on hand a small rapid response vehicle for fighting wildfires in their municipality:

> *"It took us about 3 years to build the small rapid response vehicle, get all the money together, and all the donations together on it. It's a slow process because you want to make sure you do it safely... So it was all donations [that helped build the vehicle]... [and the municipality] supplied us with $1000.00 for gas to run it [the vehicle]."*
>
> **- Fire Department**

Municipal governments also needed to have personnel (e.g. fire fighters) on hand that were trained to fight wildfires, which involved a different approach to extinguish the blaze than fighting a structural fire. However only six participating municipal governments said that they did not have specifically trained wildland-urban interface firefighters, while 14 municipal governments identified that their firefighters had up to date training for fighting wildfires. One participant identified the need for experience and proper training with fighting a wildfire, and what can go wrong if there is not proper training and experience about fighting wildfires for municipal firefighters:

> *"You need to have well trained fire fighters who have experience in wildfires because structural fire fighters attack the root of the fire, [be]cause they are trained to do that in terms of structural fire fighting. But in wildfires you have to learn to approach from the burn side and to attack your fire differently, and try to flank it and contain it that way. And I have had to save one fire fighter this year because he was overcome with smoke, just because he did exactly that, he attacked it straight on and then the wind... changed direction... so that is where the experience factor comes into play... you learn that [the difference between structural fires and wildfires] very quickly, that you have to approach a wildfire differently."*
>
> ***- Chief Administrator***

This can be viewed as an investment in human capital.

Mutual aid agreements were created in advance of an emergency, allowing municipal governments to determine the resources available within and surrounding their municipality that could be used or called upon in the event of a wildfire or other hazard. Equipment such as communication systems and emergency vehicles (e.g. smaller lighter attach vehicles, aircraft, helicopters with buckets, light weight firefighting gear specifically for wildland firefighting) were collected under these mutual aid agreements by participating municipal governments. Mutual aid allows municipal governments to document in written agreements the internal resources that they could loan to or borrow from neighboring municipal governments in the event of an emergency. Every one to four years these mutual aid agreements were updated and maintained. These mutual aid agreements were also established between some participating municipal governments and local industries such as forestry, mills, oil and gas and the provincial government in cases where towns were located in isolated areas, as well as within municipal districts and counties. In these cases these municipal governments were not be able to receive mutual aid from their surrounding municipalities, and therefore relied on equipment and personnel from local industries and the provincial government to assist them in the event of a wildfire. One participant from an isolated municipality expressed his concern about the need to obtain external resources from surrounding municipal governments:

> *"We're 90 miles away from anything, so we don't have anything in place that ... would be able to get here quick enough."*
>
> ***- Fire Department***

Similar to the results of the national survey completed in the United States by Clarke (2006), this study found that municipal governments were largely dependent on the private sector and higher government for equipment that was a large capital investment, because the municipal government did not have funding to buy this equipment themselves. This study also found that similar to Reams *et al.'s* (2005) findings, inadequate funding and the need for more technical assistance were factors that affected the implementation of wildfire risk management measures. Therefore, Canadian municipal governments and state and county governments in the United States have similar resource factors that influence the implementation of wildfire risk management measures.

8.6 Municipal Geography

Landscape conditions (topography and age of the vegetation), climatic conditions, human conditions (the transient population moving into natural areas) and the size, location and isolation of the municipality also contributed to how effectively a municipal government can implement wildfire risk management measures.

Landscape characteristics such as topography and vegetation influenced (both positively and negatively) municipal governments' implementation of wildfire risk management measures. Concerned municipal participants were all aware of their local environment and how this could affect their ability to effectively implement wildfire risk management measures. Varying terrain such as valleys and slopes within several municipalities hindered the municipal government's ability to complete vegetation management because the municipal governments could not effectively and safely place personnel and equipment on the uneven terrain to reduce the fuel load in these areas. Participants from several participating municipal governments identified the need to complete vegetation management along slopes bordering rivers and creeks as recent flooding had occurred causing increased vegetation growth and this vegetation was beginning to dry out becoming an area of high wildfire concern. This resulted in the participating municipal governments' needing to further plan (stage 3B) on how to remove the vegetation from these areas. These areas were important for municipal governments to manage because slope in combination with wind will allow a wildfire to move faster (Schwab *et al.* 2005), and if structures are located at the top of a slope, they have less of a chance to remain intact.

Changing climatic conditions concerned the majority of municipal participants:

> *"The summers seem to be a lot warmer now and drier now, than they were in the past."*
>
> ***- Fire Department***

These hotter, dryer summers have the potential to increase the number of wildfires, leading municipal governments to increase their desire to implement wildfire risk management measures more effectively. Changing climactic conditions also increase their awareness that a wildfire could occur.

Many participating municipal governments commented on the influx of people into their municipalities due to Alberta's current economic boom, which may hinder their effective implementation of wildfire risk management measures. The people moving into participating municipalities may not be familiar with wildfires and how to protect themselves and their properties, and therefore municipal governments' need to educate these individuals about wildfires. Schwab *et al.* (2005) concluded that more people in the United States are moving into fire-prone areas, and that only a few of these homeowners are minimally aware of the wildfire risk and ways to successful coexist with nature. This resulted in the need for municipal governments to communicate with their new residents and inform them of wildfire mitigation and preparedness measures that could be implemented on private property, as a municipal government might not be able to protect a homeowner's home during a wildfire:

> *"...Our long term residents [are aware of wildfire management measures], [but] we are seeing a larger quantity of city people that are moving into the country residential areas and there's some difficulties there, because the...people [who have] moved from the city to country residential... still expect city level protection and services. But our long-term residents kind of understand that... it's a trade off. When you live in the rural areas... your level of protection is lower and that there are certain things that you [residents] have to be prepared to help yourself a little more."*
>
> ***- Fire Department***

However, the participating municipal governments in this study were struggling to communicate with the increasing number of new homeowners as municipal resources were already stretched. This is especially true for the majority of rural municipalities (municipal districts and counties), because members of the fire department who were responsible for distributing and communicating with residents about wildfires were volunteers.

Several participating towns were located in isolated and remote areas of the province. These participants were concerned about escape routes because these municipalities often only had one road in and out of the town. One participant identified that depending on where a wildfire occurred, either within or surrounding the municipality, the evacuees may or may not be able to leave the town:

> *"We do have limited access... to the town, basically with one highway in, and depending on where the fire is, it may or may not allow us to actually get out."*
>
> ***- Fire Department***

Participants in isolated municipalities were also concerned that if a wildfire occurred and the municipality was not able to evacuate, resources would not be able to arrive. As a result these isolated municipal governments had to be self-reliant. These isolated municipal governments had closer ties with the forestry and oil and gas industries and the provincial government rather than other municipal governments surrounding them. Industries frequently supplied the isolated municipal governments with resources (e.g. equipment and personnel to run the equipment), while the provincial government also provided assistance through resources and assisted the municipal governments to implement communication and vegetation management measures. This would influence the wildfire implementation process because these isolated municipal governments must be aware during the resource collection stage that they may not have quick access to resources from surrounding municipal governments and higher government. Municipal cooperation with industry also assisted in the municipal implementation of wildfire risk management measures because municipal governments were able to contract out vegetation management to forestry companies.

Ultimately these isolated municipal governments had an increased awareness that they could be significantly affected by a wildfire and unable to quickly receive support from surrounding municipal governments, and therefore had to be self-reliant and implement wildfire risk management measures well before a wildfire could occur:

> *"Basically, I think it comes back to the fact that we realize that we are in a high-risk area. We're basically in the middle of wildland... the forest comes basically to the edge of town. We are isolated by the fact that our nearest mutual aid is 140 kilometres, so we have to be somewhat self sufficient on that side. I know that I have, or I*

> *have heard that [town C] is a very high risk area for a wildfire threat, and that we haven't had one in quite some time, and statistically it says that we could be, it should be happening at any given point here, so as time progresses your chances increase, so. And that being recognized, and with our limited access to get out, should something occur, we have to kind of be prepared for it early, and the town recognizes that, which is why they've kind of initiated the whole process of the evaluation and implement the recommendations fully..."*
>
> ***- Fire Department***

Many municipal participants also identified their municipality's size as a reason why it was difficult to implement wildfire risk management measures. Participants from larger municipalities such as municipal districts and counties expressed concern that they struggled to effectively implement wildfire risk management measures as a result of their municipality's large size.

> *"I would have to say shear size. We have so many areas that require... attention and... not enough resources to go to them. But I would say in... most facets of running the municipality that is probably our one hindrance is the shear size of the county."*
>
> ***- Fire Department***

Similarly, Labadie (1984) identified that larger municipalities have more funding for emergency management but the demands on their funds are correspondingly larger. These larger municipalities felt that smaller municipalities had increased success in implementing wildfire risk management measures, because they could more evenly distribute their collected resources, since the smaller municipalities had a smaller area to cover. However, smaller municipal districts/counties and towns also expressed difficulty in effectively implementing wildfire risk management measures because they received fewer resources than larger municipalities:

> *"I think the biggest issue, if the provinces are looking how things are run, as far as wildfire management, would be resources to the*

> *municipalities. It all comes down to dollars, so if the resources are required it always cost money. These small municipalities are all strapped already trying to keep their towns and villages up to snuff and going. I think it basically comes down to dollars."*
>
> ***- Fire Department***

The city representatives included in this study did not identify the size of their municipality as a factor influencing their ability to implement wildfire risk management. This is potentially because cities had isolated areas within their municipality where wildfires could occur and only had to use their resources in these specific areas, rather than throughout the entire municipality.

Municipal geography including municipal topology, size, location and isolation were also identified by Jakes *et al.* (2003) as landscape factors affecting community preparedness for wildfires. In addition to these landscape factors, climate and population movement were also identified in this study, as influencing municipal governments implementation of wildfire risk management measures. Uneven terrain and slopes affected a municipal government's ability to implement vegetation management measures, while a municipality's size, location and isolation affected the distribution of resources to implement wildfire measures.

8.7 Chapter Summary

This study identified six factors (past wildfire experience, risk perceptions, communication, support, resources and geography) that influenced participating municipal governments' ability to implement wildfire risk management measures. Past experience with a wildfire seemed to increase a municipal government's desire to protect their municipality from a wildfire by implementing wildfire risk management measures. Higher risk perceptions also lead municipal participants to understand the need to implement wildfire risk management measures within their municipality. Communication (both one-way and two-way techniques) was another important factor that affected a municipal government's ability to implement wildfire risk management measures. Participating municipal governments that used both one-way and two-way communication techniques between municipal officials and the public were able to more effectively implement wildfire measures with minimal or no controversy and public outcry. Municipal support from internal and external agencies in the form of acceptance that wildfire risk management measures need to be implemented and access to resources for the implementation process lead to municipal governments being able to implement wildfire risk management measures. Access to resources (e.g. funding, time, personnel and equipment) was important for municipal governments because without them participating municipal governments were not able to implement wildfire risk management measures. Municipal geography influenced the implementation of wildfire risk management measures because varying terrain increased the difficulty of vegetation management, while changing climatic conditions may increase the potential of wildfire occurrence, leading to the need to implement wildfire risk management measures. Municipal isolation caused particular municipal governments to become more self-reliant, increasing their ability to implement wildfire risk management measures but also potentially reducing their access to resources if a wildfire were to occur. The influx of people in the participating municipalities hindered municipal governments' ability to effectively communicate with all members of the public about the potential threat of wildfires and wildfire mitigation and preparedness measures that could be implemented by residents.

CHAPTER NINE

Conclusions & Recommendations

9.1 Conclusions

Alberta is at high risk of wildfires (forest fires, grass fires, and brush fires) due to the expanse of boreal forest and other vegetation covering the province and the increasing number of people living and moving into these areas. To prevent loss of property and life, municipal governments must have a proactive approach to wildfire management rather than waiting for and reacting to a wildfire.

The first research question this study addressed is *what* wildfire risk management measures have been adopted by a sample of Alberta's municipal governments. The results of this study show that emergency preparedness plans, infrastructure measures, communication, wildfire hazard assessments, vegetation management, land-use planning, and structural measures were being implemented by 18 Alberta municipal governments. All municipal governments had implemented some of these wildfire measures although the majority of the participating municipal governments had not implemented all seven wildfire risk management measures.

The second research question this study addressed was *why* some wildfire risk management measures were used more frequently than others. Emergency preparedness plans were most frequently implemented because municipal governments were required by provincial law to have these plans in place. Infrastructure measures were the second most frequently implemented because this wildfire measure could be incorporated into municipal development plans, which would then become regulatory, this measure might have also been implemented for reasons other than wildfire risk management. Communication was the third most frequently implemented wildfire measure because of its ease to initiate, particularly the distribution of one-way communication techniques. Wildfire hazard assessments was the next frequently implemented wildfire risk management measure because this measures needed to be completed prior to vegetation management to identify high risk areas. Vegetation management was the fifth frequently used wildfire risk management measure because of its' perceived benefits as well as being one of the most common and best known ways to reduce a wildfire threat by reducing the fuel source. However, it was fifth on the list because it required municipal resources (funding, time, personnel, and equipment), which were lacking in many municipalities. The participating municipal governments infrequently used land-use planning, because some planning officials were not involved in the implementation process. Structural measures implemented on government buildings were the least frequently implemented wildfire measure. This may have been a result of cost, the location of government buildings within the municipality, or that municipal government buildings do not need updating at the present time.

The third research question of this study addressed what is the municipal process for implementing wildfire risk management measures and how is the process implemented. This study identified a complex six-stage process that was used to implement wildfire risk management measures (Figure 7.1). Completing each stage in the process allowed municipal governments to implement an increased number of wildfire risk management measures and avoid setbacks (e.g. public outcry). The process begins by having a municipal *spark* identify that their municipality could be affected by a wildfire, and that wildfire risk management measures should be implemented to reduce the wildfire threat, leading to the development of a wildfire risk management proposal. All participating municipal governments were completing this stage. In the second stage, the *spark* takes the wildfire risk management proposal to council and addresses other municipal officials (e.g. the mayor/reeve, councillors, other department heads) about the need to implement wildfire risk management measures, and looks for municipal acceptance of the proposal. All participating municipal governments were also completing this stage of the process. Stage three involves several steps, 3A requires gathering resources to implement wildfire risk management measures. Step 3B involves updating the wildfire risk management proposal, identifying which departments will be involved and outlining what wildfire measures will be used and where they will potentially be implemented. Step 3C involves municipal officials acknowledging that support is needed from potentially affected parties (residents, environmental groups, businesses, and industries), then communicating with these individuals about wildfires and the need to implement wildfire risk management measures. Steps 3A and 3C cause problems for a number of participating municipalities. Stage four involves the municipal government communicating their wildfire risk management proposal with the potentially affected parties, gathering feedback, and answering questions about how wildfire measures will be implement and coming to a collective conclusion about what wildfire measures to implement, how the measures should be implemented, and when and where the measures will take place. This stage will continue until the wildfire risk management proposal is accepted as a plan. Some participating municipal governments also experienced setbacks during this stage. Stage five is the implementation of the wildfire risk management measures identified in the wildfire risk management plan. A few participating municipalities experienced setbacks during this stage if stage 3A and 3C were not completed. Finally, stage six is the updating, reassessing, and maintaining the implemented wildfire risk management measures, particularly vegetation management, once the wildfire measures have been completed. If a municipal government missed one or more of these six-stages, setbacks occurred in the remaining stages of the wildfire implementation process.

The final research question of this study addressed what factors were influencing the implementation of the wildfire risk management measures, and how these factors influenced the process. Municipal officials' personal experience with wildfires was a factor that influenced municipal governments' ability to implement wildfire risk management measures, because they lacked officials who knew wildfire measures and how to implement them effectively. Without experienced municipal officials, municipal governments were negatively affected in their ability to implement wildfire risk management measures. This study also identified perceptions of wildfire risk as a factor that could influence the implementation of wildfire measures. A low risk perception among municipal officials and the public, mean that these individuals may not understand the importance of implement wildfire risk management measures, and therefore may not place a priority on implementing these measures. Communication at every stage influences the implementation of wildfire risk management measures. Without effective communication individuals who should be included in the process but are not, can hinder the wildfire implementation process because they want to be heard. Support in the form of acceptance and understanding of the need to implement wildfire risk management measures from all sectors (e.g. council, the public, industry and higher government) is essential during the municipal wildfire implementation process, because without support setbacks can occur in the process. Without access to sufficient resources (e.g. funding, time, personnel, and equipment) a municipal government cannot implement wildfire risk management measures. As resources allow a municipal government to implement wildfire risk management measures. Municipal geography can also influence the wildfire implementation process because without a proper awareness of a municipality's unique geography (e.g. isolation, vegetation, climatic conditions, and population movement) municipal governments cannot effectively protect their jurisdiction from a wildfire, as different vegetation management approaches are needed to remove vegetation from a variety of terrains, and climatic conditions could increase vegetation growth requiring regular assessments and maintenance.

The results of this study confirm the factors (social capital, human capital, cultural capital, agency involvement and landscape) identified by Jakes *et al.* (2003), which affect community wildfire preparedness, also affect the wildfire management process implemented by municipal governments in Alberta, Canada. This study found that the leadership and mobilization of resources, also known as social capital, were directly identified. Leadership particularly from the *sparks* was a necessity for a municipal government to implement wildfire risk management measures. Resources (e.g. financial, time, personnel, and equipment) needed to be accessible to affectively implement wildfire risk management measures. Human capital was an important criteria identified in this study, as individuals' such as municipal officials' knowledge and skills learnt from education and training increased their understanding of the damage wildfires can cause and the need to implement risk management measures to reduce the potential threat within their municipality. Human capital is important because if a municipal government has low human capital there is a reduction in support for wildfire risk management measures. Cultural capital was also identified as a factor affecting municipal governments implementation of wildfire risk management measures. Wildfire experience resulted in municipal officials understanding and acceptance of the need to implement wildfire risk management measures in their municipality. Agency involvement was another factor that contributed to the municipal implementation of wildfire risk management measures, because one municipal department such as the fire department cannot successfully implement wildfire risk management measures by themselves. Municipal governments who communicated with residents, environmental groups, businesses, industries, higher government and/or other municipal governments had greater access to resources and support for the implementation of wildfire risk management. Alavalapati *et al.* (2005) and Dombeck *et al.* (2004) identify that the planning and implementation of wildfire risk management measures in the wildland-urban interface requires a dynamic collaboration among a diverse group of people. Landscape (e.g. municipal isolation) was also identified in this study to influencing municipal governments implementation of wildfire risk management measures. As communities in the United States and municipal governments in Canada have identified that they may not have access to sufficient resources to fight a wildfire, and therefore need to be prepared in advance to minimize this potential situation. Although this study found that climatic condition and human movement were additional landscape factors. Therefore, social capital (leadership and resources), human capital (knowledge and skills learnt from education and training), cultural capital (knowledge and skills learnt from experience and place attachment), agency involvement, and landscape identified by Jakes *et al.* (2003) as affecting community wildfire preparedness were also factors that influencing the implementation of wildfire risk management measures by municipal governments in Alberta, Canada.

Bureaucratic issues and competing municipal resource interests identified by McCaffrey (2004a), Plevel (1996), and Gardner *et al.* (1987) were also identified in this study as influencing the implementation of wildfire risk management. Competition occurred between the need to implement wildfire risk management measures versus other municipal activities. In this study conflict also occurred within a municipality (e.g. between municipal officials), and between a municipal government and residents, and municipal governments and industry.

There are several similarities and differences that appeared when comparing this study's finding to those of Reams *et al.* (2005) who examined state and local governments in the United States. In both studies communication programs were being completed by the majority of participating governments, however, Reams *et al.* (2005) found that state and local governments in the United States focused predominantly on wildfire education in public and high school curriculum. The majority of state and local governments in the United States also focused on completing wildfire hazard assessments on public and private land, examining vegetation management, home construction materials, road design and access, water availability, and appropriate signage (Reams *et al.* 2005). This study found that the majority of municipal governments in Alberta, Canada were focused on infrastructure measures (e.g. road design and access, and water availability), many were implementing wildfire hazard assessments and vegetation management, while only a few were implementing structural measures specifically on government buildings. State and local governments in the United States were also more likely to use land-use planning regulations (e.g. subdivision regulations, bylaws, and regulating wildfire mitigation measures), than municipal governments in Alberta, Canada. Both the study by Reams *et al.* (2005) and this study in Canada identified a lack of resources (e.g. funding and personnel), negative public support, and inadequate public input in to wildfire management as hindering government implementation of wildfire management.

Plevel (1996) identified eight factors that influenced local government's ability to implement policies, which could reduce the impact of wildfires in the United States (see section 4.2.3). All eight of these factors were found to influence participating municipal governments in this study during their implementation of wildfire risk management measures. Therefore, the factors influencing United States local governments' implementation of wildfire policies also appear to be affecting local government in Alberta.

9.2 Recommendations

Firstly, there is a need for regular one-way and two-way communication between municipal officials, and potentially affected individuals (residents, environmental groups, businesses, and industries). This continual communication will increase awareness of wildfires and wildfire risk management measures that are available for implementation at the forefront of people's minds. One-way communication allows municipal governments to provide general information about wildfires and available wildfire risk management measures to a large number of people. Two-way communication allows municipal governments to interact with potentially affected individuals such as residents, environmental groups, businesses and industries, and identify how wildfire risk management measures can be implemented. Two-way communication also allows questions and concerns posed by the public and municipal officials to be answered by experienced and knowledgeable municipal staff.

Secondly, municipal officials must regularly identify the risk perceptions of their public as well as their residents' understanding of the wildfire information that has already been distributed, this will allow municipal officials to tailor their wildfire risk management information to keep support high, while providing information that is informative and non-repetitive.

Thirdly, municipal governments should increase the use of land-use planning measures, such as subdivision design and fire resistant building codes, which would allow a municipal government to minimize the wildfire risk *before* residents move into an area, rather then trying to persuade homeowners that the implementation of wildfire risk management measures on public and private land is necessary after residents have moved into a high hazard area (also see Schwab *et al.* 2005). Municipal governments should implement structural measures on government buildings, because it would mean that residents would be able to see that implementing structural measures on their homes will not affect the aesthetic values of their home and also identify to residents that their municipal government is also taking action and implementing structural measures to protect municipal buildings. This municipal action may then lead homeowners to implement structural measures on their own homes, which would assist the municipal government in further increasing protection of their municipality from a wildfire.

Fourth, municipal governments should create, communicate and market their proposal for implementing wildfire risk management measures alongside other municipal concerns (e.g. reducing mosquito and pine beetle habitat), allowing them to potentially receive more funding and support to implement wildfire risk management measures if other municipal concerns were reduced simultaneously.

Fifth, municipal officials should acknowledge that public support is critical during the implementation of wildfire risk management measures, particularly during the planning stage when a municipal government is identifying what wildfire risk management measures should be completed and where these measures will be completed. Acknowledgement of public support and public involvement opportunities will lead to the engagement of the public early in the wildfire implementation process. Without public support, municipal governments will face setbacks and may potentially be prevented from implementing wildfire risk management.

Sixth, the implementation of wildfire risk management measures needs to be a collaborative endeavor involving the fire department, planning and parks departments, the mayor/reeve, the chief administrators (councillors, Chief Administrative Officer, Director of Disaster Services, and Directors of Emergency

Services). Other municipal departments may become involved if they feel they could contribute and assist in the wildfire implementation process. In particular, municipal planners should be involved during the wildfire implementation process because they can add their expertise in land-use planning, infrastructure and structural measures, and increasing communication with the public. Involvement from parks departments (if they are present in the municipal government) would remove pressure from the fire department as the parks department, using their expertise and equipment, would be able to assist with vegetation management and wildfire hazard assessments on public land within the municipality and provide the fire department with more time to complete two-way communication with homeowners, council, and other department heads.

Seventh, some municipal governments are reliant on the provincial government for communication programs and financial resources. In order for municipal governments to be more self-reliant, they could hold community wildfire days, where members of the community come together and complete wildfire risk management measures such as vegetation management on public land, which would reduce the amount of funding needed to pay personnel. For example, in Jasper National Park in Alberta, Canada, fire prevention officials have been working with local residents to collectively come together and complete vegetation management in their neighbourhood (Westhaver undated). Municipal governments could also interact more regularly with industries and have them sponsor wildfire risk management activities, because it would be in their best interest to keep their municipality protected. Municipal governments could also create incentive programs, so residents could receive tax breaks if they implemented wildfire mitigation and preparedness measures on their own properties. Municipal governments could also select residents, business and industry representatives from within the municipality who are supportive of wildfire risk management and who are taking action themselves to protect their property from a wildfire, and have these individuals assist with communication programs. Other individuals within the municipality may become more supportive of wildfire risk management if someone that they are familiar with is communicating about risk management.

Eighth, provincial government must remain supportive and assist municipal governments to implement wildfire risk management measures by providing expertise, as well as resources (financial, time, personnel, and equipment). For example the provincial government could assist municipal governments by providing resources and together complete two-way communication techniques with potentially affected individuals (e.g. residents, environmental groups, businesses, and industries). If wildfire communication extended throughout the entire province then everyone in Alberta would be aware of wildfires and the wildfire risk management measures that could be implemented to reduce their risk. People moving within the province would still have an awareness of a wildfire issue regardless of the local vegetation type. The provincial government should also increase awareness of available funding sources (e.g. Municipal Wildfire Assistance Program), to assist municipal governments outside the Forest Protection Zone with their implementation of wildfire risk management measures.

9.3 Direction of Future Research

Further research is needed in several areas. Research should examine what land-use planning measures (e.g. bylaws, zoning, covenants, subdivision designs) have been implemented by local government and examine how these measures have been implemented, and their effectiveness in reducing the damage caused by wildfires. This study would identify how planners could effectively implement a variety of land-use planning measures to increase their municipality's protection from a wildfire.

It would also be useful to study the effectiveness of communication techniques used by local governments (e.g. open houses). The present study has identified a variety of one-way and two-way communication techniques being used by municipal governments in Alberta, however the effectiveness of each technique in providing information about wildfire risk management measures and how to implement these measures requires further study.

A quantitative study could be developed to identify wildfire risk management measures that municipal governments across Canada are implementing to reduce their risk from wildfires. This would allow for a comparison of municipal governments across the country to identify if they are completing similar wildfire risk management measures. A qualitative study could also be completed to determine how other municipal governments in Canada are implementing wildfire risk management measures, and the factors influencing the implementation process. This would determine if other municipal governments are using a similar process and if similar factors are influencing wildfire risk management implementation across the country.

Research could also be completed comparing the involvement of municipal/local planners in Canada and the United States. This comparison would identify how local planners in the United States are involved in wildfire management versus municipal planners in Canada, and possible ways to included Canadian municipal planners in the wildfire implementation process.

Finally, it would be useful to study why structural measures are not widely implemented on government buildings, which may provide insight into impediments in adopting this measure and how to better implement structural measures within municipal government in the future.

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Appendix A- Letter of Intent

Dear (*Name Here*) (T*itle*),

A team of researchers from the University of Alberta and the Canadian Forest Service are currently conducting a 3-year research project in Alberta on the human dimensions of wildfires (including forest fires, grass fires and brush fires) and their management. I (Lauren Harris) will be completing part of this 3-year project for my Masters degree. My project includes two phases. The **first phase** will involve a brief survey and telephone interviews with key municipal government contacts including the fire chief, mayor and senior planner. The second phase of this project will involve in-person interviews with two of the municipalities sampled in phase one. These interviews will occur in October 2006, with municipal representatives (Alberta Sustainable Resource Development, residents, an official from both Oil and Gas and Forestry Industries, and Public Lands and Forest Division). These interviews will compare and contrast one municipality, which has implemented many wildfire mitigation and preparedness measures, with another municipality that has implemented fewer measures. This will provide a detailed account of how specific measures are implemented, as well as what factors are affecting implementation of wildfire mitigation and preparedness measures in Alberta's municipalities.

We would like to invite you to share your views by participating in a brief survey and interview for Phase 1 of this project. Participants should complete the survey first (attached to this letter), and then this will be followed up by a telephone interview. *The survey seeks information about the types of wildfire mitigation and preparedness measures that your municipality is implementing or plans to implement*. The interviews will take place during the month of June 2006. *The telephone interviews will elaborate on the municipality's implementation of wildfire measures and examine the factors that may be hindering or helping in the implementation of these measures*. The interviews are anticipated to last 1 hour, and will be completed over the telephone. With your permission, the interview will be audiotape recorded. The information that you provide in the survey and during the interview will be kept confidential. The name of interview participants will not be recorded on the survey, interview tapes or transcribed interview notes. The survey and transcribed interview notes from all of the interviews will be summarized and analyzed, and presented in a final report and any publications arising from this project. If we use a direct quote from an interview participant in a report or publications, a label such as 'mayor', 'planner', or 'fire chief' will be used to describe the source of the quote. You may ask us not to quote your words at all if you prefer. All interview tapes and transcripts will be stored in a locked filing cabinet in my office during the study. Once the study is completed the data will be moved to a locked filing cabinet in Dr. Tara McGee's office at the University of Alberta, and will only be available to Drs. McGee and McFarlane and Ms. Harris for this project.

The results of this study will be summarized in final reports that will be provided to NSERC, SSHRC, and Canadian Forest Service, Alberta's Sustainable Resource Development (SRD), Institute of Catastrophic Loss Reduction (ICLR), ATCO electric, Canadian Interagency Forest Fire Centre (CIFFC), which are funding this project. The results of this research will assist provincial agencies and municipal governments in Alberta and throughout Canada to develop, strengthen and implement wildfire mitigation and preparedness measures. The potential risk associated with participating in this project is minimal. Please do not hesitate to contact us for information about this study at any time. At the end of the project, you can obtain a copy of the final project reports by making a request during the interview, or at any other time by contacting Dr. Tara McGee at (780) 492-3042. A summary of the project findings will be sent to each municipality at the end of the study.

Your participation is voluntary, and you are free to provide as much or as little information as you wish during the survey and interview. You may withdraw from further participation in the project at any time during the data collection phase of the project. In such a case, we will not use any of the information that you have provided.

Please do not hesitate to contact us if you have any questions about this project. **We will contact you by phone within the two weeks, to find out if you would be interested in participating in an interview. Alternatively, you may contact me (Lauren Harris) to set up an interview at your convenience.** Thank you.

Ms. Lauren Harris, Department of Earth and Atmospheric Sciences, University of Alberta, (780) 492-5879, email lmharris@ualberta.ca

Dr. Tara McGee, Department of Earth and Atmospheric Sciences, University of Alberta,
(780) 492-3042, email tmcgee@ualberta.ca

Dr. Bonita McFarlane, Canadian Forest Service, Edmonton, (780) 435-7383, email bmcfarla@nrcan.gc.ca

Primary Researcher: Lauren Harris ____________ Date ____________

Supervisor: Dr. Tara McGee ____________ Date ____________

Advisor: Dr. Bonita McFarlane ____________ Date ____________

Appendix B- Consent Form

If you are interesting in participating in this study please complete this ***CONSENT FORM*** **and return it by fax ((780) 492-2030) to Lauren Harris c/o Dr. Tara McGee.**

Research Project:
An examination of how Alberta's municipalities are implementing wildfire mitigation and preparedness measures, and the factors that may be helping and hindering the implementation process.

Investigators:
Miss. Lauren Harris, Department of Earth and Atmospheric Sciences, University of Alberta, (780) 492-5879, email lmharris@ualberta.ca

Dr. Tara McGee, Department of Earth and Atmospheric Sciences, University of Alberta, (780) 492-3042, email tmcgee@ualberta.ca

Dr. Bonita McFarlane, Canadian Forest Service, Edmonton, (780) 435-7383, email bmcfarla@nrcan.gc.ca

Consent:
Do you consent to being audiotaped?
Do you understand that you have been asked to participate in a research study?
Have you received and read a copy of the introduction letter?
Do you understand the benefits and risks involved in taking part in this research study?
Have you had the opportunity to ask questions to discuss this study?
Do you understand that you can withdraw from participation in this project at any time?
Has confidentiality been explained to you?
Do you understand who will have access to the information that you provide?
Do you understand what the information you provide will be used for?

Interview Participant Signature	Date
Please print name here	Your contact telephone number

Appendix C- Phase 1: Survey

Thank you for agreeing to participate in this study.

This study is being completed to determine:

- ***What*** measures your municipality is implementing to reduce the impact of wildfires occurring where forests and other vegetation intermingle with human settlements in your municipality)?
- ***How*** these measures being implemented (***who*** is involved in this process, ***where*** are the measures being implemented, and ***when*** the measures are being implemented (past, present or future)?
- Examining the ***factors that are helping*** your municipality to implement wildfire mitigation and preparedness measures, and the ***factors that are hindering*** your municipality's ability to implement wildfire mitigation and preparedness measures.

Terms:

- ***Wildfire*** incorporates forest fires, grass fires and brush fires.
- ***Mitigation*** refers to the long-term actions that reduce a community's vulnerability to a hazard, including vegetation management and structural building measures that will increase a building's resistance to fire.
- ***Preparedness*** is the ability to cope with a disaster and reduce its impact by having prior planned and implemented resources (i.e. mutual-aid agreement and developing an evacuation plan).

Instructions:

This survey will take approximately 5-15 minutes to complete. Please complete this survey, then fax **(780) 492-2030** it to Lauren Harris c/o Dr. Tara McGee. The results of this survey will help to focus our phone interview, reducing the interview completion time and allowing me to gather specific details regarding your municipality's implementation and intentions to implement of wildfire mitigation and preparedness measures.

I look forward to discussing your survey responses during the telephone interview, and will be in contact with you over the next two weeks to schedule a convenient interview time.

Sincerely,
Lauren Harris

Phone (780) 492-5879,
Fax: (780) 492-2030, c/o Dr. Tara McGee
Email: ***lmharris@ualberta.ca***

Section I: Wildfires in your Municipality

Has your municipality been affected by a wildfire in the last 20 years?
YES _____ NO _____ UNSURE _____

If YES, which type(s) of wildfire has your municipality been affected by? (Check all that apply):
Forest Fire: ____________
Grass Fire: ____________
Brush Fire: ____________
Other: *(please specify)* ______________________________

Which type(s) of wildfire could affect your municipality? (Check all that apply):
Forest Fire: ____________
Grass Fire: ____________
Brush Fire: ____________
Other: *(please specify)* ______________________________

Section II- Communication & Educational Measures

1. Has your municipality undertaken or is it currently completing any formal or informal ***Communication or Education*** such as providing seminars, brochures/pamphlets, informal telephone conversations, media articles, etc. about Wildfire Mitigation and Preparedness Measures?

   YES _____ NO _____ UNSURE _____

   a. ***If YES,***
      i. Was this communication or education for the *Municipal Leaders* (such as the mayor, fire chief, and municipal government department heads) and *First Response Personnel* (such as individuals who are first on the scene- fire department, police, ambulance)?
      YES _____ [✓ NO _____] UNSURE _____

      ii. Was this communication or education for the Residents of the municipality?
      YES _____ NO _____ UNSURE _____

      iii. Was this communication or education for *Businesses (such as Accommodation Providers, Local Businesses)* in your municipality?
      [✓ YES _____] NO _____ UNSURE _____

iv. Was this communication or education for *Industry (such as Oil & Gas, Forestry, Agricultural)*?
YES _____ NO _____ UNSURE _____

b. ***If NO,*** is your municipality planning to complete any formal and informal communication and education in the future with:

1. Municipal Leaders/First Response Personnel?
   YES__ NO ___
2. Residents? **YES __ NO ___**
3. Businesses? **YES __ NO ___**
4. Industries? **YES __ NO ___**

Section III- Vegetation and Structural Measures

2. Has your municipality undertaken or is it currently completing ***Vegetation Management*** for the purpose of wildfire mitigation and preparedness, including thinning, pruning, clearing or replacing fire prone vegetation with species that are more resistance to fire?

YES _____ NO _____ UNSURE _____

a. ***If YES,***

i. Has your municipality undertaken thinning, pruning or clearing of vegetation in and around the municipality, specifically for wildfire reduction?
YES _____ NO _____ UNSURE _____

ii. Has your municipality created a municipal fireguard involving the significant thinning or clearing of vegetation and dug trenches, on a strip of strategically located land, around your municipality, used to reduce the spread of a wildfire?
YES _____ NO _____ UNSURE _____

iii. Has your municipality planted fire resistant vegetation such as aspen and poplar to minimize the impact of a wildfire?
YES _____ NO _____ UNSURE _____

iv. Does your municipality provide any services to residents to assist them in thinning, pruning or clearing vegetation?
YES _____ NO _____ UNSURE _____

1. ***If YES,*** is this a free _ OR cost-sharing __ service?

v. Does the municipality provide any services to residents to assist them in the successful disposal of vegetation debris?

YES _____ NO _____ UNSURE _____

1. ***If YES,*** is this a free _ OR cost-sharing _ service?

2. ***If NO,*** does the municipality inform residents how to appropriately dispose of vegetation debris to reduce the likelihood of a wildfire occurring?
YES _____ NO _____ UNSURE _____

b. ***If NO,*** is your municipality planning to complete any vegetation management in the future?
YES _____ NO _____ UNSURE _____

3. ***Structural Measures*** include building with or replacing building materials with fire resistant materials (i.e. brick and stucco material for siding, clay or concrete tile or fibreglass/asphalt composition shingles for roofs, etc.).

   a. Has your municipality undertaken or is it currently completing any structural measures on government building?
   YES _____ NO _____ UNSURE _____

   b. Has the municipality *encouraged* residents to complete these measures on their own properties?
   YES _____ NO _____ UNSURE _____

   c. Has the municipality *encouraged* businesses to complete these measures?
   YES _____ NO _____ UNSURE _____

   d. Has the municipality *encouraged* industry to complete these measures?
   YES _____ NO _____ UNSURE _____

   e. ***If NO,*** is your municipality planning to complete any structural measures in the future?
   YES _____ NO _____ UNSURE _____

4. Has your municipality undertaken or is it currently completing ***Infrastructure Management*** measures to increase safety for residents and firefighters and improve response time, if a wildfire were to occur (e.g. roadways, water supply and utilities).

   YES _____ NO _____ UNSURE _____

   a. ***If YES,*** has it been to:

i. Ensure adequate water supply throughout the municipality, which firefighters can use to extinguish a wildfire and people can use to protect their homes from a wildfire?
YES _____ NO _____ UNSURE _____

ii. Ensuring adequate road width to allow for emergency vehicle turn-around, and allowing emergency vehicles into an area while residents evacuate the area?
YES _____ NO _____ UNSURE _____

b. ***If NO,*** is your municipality planning to complete any infrastructure measures in the future?
YES _____ NO _____ UNSURE _____

Section IV- Wildfire Planning Measures

5. Does your Municipality have an ***Emergency Preparedness Plan*** that can be implemented if a natural or technological disaster occurs?

YES _____ NO _____ (skip to question 6) **UNSURE _____**

a. Does this Emergency Preparedness Plan incorporate the implementation of emergency measures specifically for a wildfire?
YES _____ NO _____ UNSURE _____

i. Are high-risk areas resulting from wildfire identified in this plan?
YES _____ NO _____ UNSURE _____

1. ***If NO,*** has your municipality mapped wildfire high-risk areas?
YES _____ NO _____ UNSURE _____

ii. Is there an established Emergency Evacuations Route(s) if people need to be evacuated from an area or the municipality?
YES _____ NO _____ UNSURE _____

1. ***If YES,*** have you informed residents and industry regarding the routes?
YES _____ NO _____ UNSURE _____

b. Does your municipality have a specific Wildfire Reduction Plan that can be implemented if a wildfire occurred?
YES _____ NO _____ UNSURE _____

6. Has your Municipality undertaken or is it currently completing ***Land-Use Planning*** measures that will minimize a wildfire occurrence in an area susceptible to a wildfire?
YES _____ **NO _____** **UNSURE _____**

   a. ***If YES***, has your municipality:
      i. Minimized or eliminated residential, business and industrial development in areas where a wildfire is likely to occur?
      YES _____ **NO _____** **UNSURE _____**

      ii. Introduced municipal bylaws or regulations *requiring* the necessary implementation of wildfire measures?
      YES _____ **NO _____** **UNSURE _____**

      iii. ***If YES,*** what type of bylaws or regulation are these? (check all that apply):
      _________Subdivision/development regulations
      _________Zoning
      _________Building Code
      _________ Land Use Code
      _________ Disclosure of wildfire risk prior to property purchase
      _________Other (please specify) ___________

      iv. ***If YES,*** what requirements does your municipality implement? (Check all that apply):
      __________ Regulations for New Construction
      __________ Regulations for All Structures
      __________ Regulations for Retrofit Structures

   b. ***If NO,*** is your municipality planning to complete any Land-Use Planning measures in the future?
   YES _____ **NO _____** **UNSURE _____**

7. Has your Municipality undertaken or is it currently completing a ***Wildfire Hazard Assessment***. This assessment allows for a property and building structure to be assessed to determine its potential wildfire ignition and the capability to control and extinguish a wildfire?

YES _____ **NO _____** **UNSURE _____**

   a. ***If YES,*** has this been completed:

i. On residents' property?
YES _____ NO _____ UNSURE _____

ii. Elsewhere in the municipality?
YES _____ NO _____ UNSURE _____

b. ***If NO,*** is your municipality planning to complete a Wildfire Hazard Assessment in the future?
YES _____ NO _____ UNSURE _____

Section V- Access to Wildfire Resources

8. ***Resources*** help a municipality to mitigate, prepare and respond to a wildfire. Such resources would include personnel, funding and equipment.

a. Does your municipality have enough wildfire ***Personnel***-

i. Specifically dedicated to wildfire mitigation implementation (e.g. people to promote wildfire education)?
YES _____ NO _____ UNSURE _____

ii. Firefighters- trained in fighting Wildland-Urban Interface Fires?
YES _____ NO _____ UNSURE _____

1. Do firefighters in your municipality receive up-dated training on how to fight Wildland-Urban Interface fire?
YES _____ NO _____ UNSURE _____

b. Does your municipality have enough ***Funding*** to mitigation and prepare a municipality for a wildfire?

i. Internal Funding to mitigate and prepare for wildfires?
YES _____ NO _____ UNSURE _____

ii. External Funding to mitigate and prepare for wildfires?
YES _____ NO _____ UNSURE _____

c. Does your municipality have enough wildfire ***Equipment*** (i.e. fire trucks, hoses, etc.) to extinguish a wildfire?
YES _____ NO _____ UNSURE _____

9. Does your Municipality have a ***written or oral agreement between other municipalities (Mutual Aid Agreement)***, to provide and/or receive

resources and any other support measures agreed upon in the event of a wildfire?

YES _____ **NO** _____ **UNSURE** _____

a. ***If YES,*** how many other municipalities do you have a mutual aid agreement with: # (_______)

Section VI

10. Is your municipality undertaking or planning to complete any ***other*** wildfire mitigation or preparedness measures?

Please ensure that you have completed all pertaining questions.
I will be contacting you within the next two weeks to set up an interview time.
Thank you very much for your time.

Please return the survey by **Fax (780) 492-2030** to: ATTN: Lauren Harris c/o Dr. Tara McGee

Appendix D- Phase 1: Interview Guide

Date: ________________________ **Code:** ________________________
Start Time: ____________________ **End Time:** ____________________

Introduction
Hello, my name is Lauren Harris and I am a graduate student at the University of Alberta. I am completing a Masters project as part of this study which aims to examine what wildfire mitigation and preparedness particular wildfire measures your municipality is implementing (if any), how you are implementing the measures, why some measures are more popular then others, and the factors that may be hindering or helping the implementation of these measures.

Terms:
Wildland-Urban Interface is where forests and other vegetation intermingle with human settlements.
Mitigation refers to the long-term actions that reduce a community's vulnerability to a hazard, including vegetation management and structural building measures that will increase a building's resistance to fire.
Preparedness is the ability to cope with a disaster and reduce its impact by having prior planned and implemented resources (i.e. mutual-aid agreement and developing an evacuation plan).

Some of the questions found in this interview will be based on your responses from the survey that you completed a few weeks ago.

Based on the letter of intent that I sent to you a few weeks ago, you are aware that this interview will take approximately 1 hour to complete and that it will be tape-recorded (which is currently no turned on)?

If at any time you would like the tape recorder turned off, please say so and I will stop the machine and not take any notes. Before we begin the interview, are you comfortable if this interview is audiotaped?

The information from this interview will be transcribed and returned to you for your approval, if there is anything in the transcript that you do not want used within this study, you can ask for it to be removed.

I have already interviewed and spoken with the _________________ (fire chief, mayor, senior planner) prior to your interview.

Do you have any other questions you would like to ask before we begin the interview?
I will now turn on the audiotape machine…
The audiotape machine is now turned on…

OPENING QUESTIONS

- I am not from Alberta. Could you tell me a little bit about your municipality, and the area of Alberta that you live in (Probe: population size, surrounding vegetation)?

SECTION I (I would like to begin by asking you a few questions regarding (your municipality) and then about wildfires).

Community Based Questions

- Do you feel that the municipality (city, town, municipal district or county) is closeknit? (do the council leaders communicate and socialize informally with residents of the municipality?)

- You said that your municipality has had past experience with a wildfire?
  Probe: What was the last year that the municipality was affected by a wf?______
  Probe: Do you know how much land was burnt? (ha, acres)

____

- What do you see the wildfire threat as CURRENTLY being (this year)?

1	2	3	4
Low	Medium	High	Unsure

  - Why do you feel it is?

- What do you see the wildfire threat as being in the FUTURE

1	2	3	4	5
Low	Medium	High	Higher	Unsure

  - Why do you feel would be? (*Probe*: concerns with climate change)?

- Do you believe that your municipality (city, town, municipal district or county) is currently prepared for a wildfire?
  YES PARTIALLY NO DON'T KNOW

    - Why do you think this?

Do you think the municipality (city, town, municipal district or county) should be concerned about a wildfire affecting the municipality?

Have you heard of the FireSmart manual by partners in protection?

Do you use the manual in your municipality?

Does your municipality have a FireSmart committee to municipal committee specifically for wildfires?
Do you know which individuals sit on the committee? (Probe: industry, residents, WPO, municipal officials)

Do the municipality have much involvement with SRD)?

SECTION II

(Survey- Sent with letter of research project intent and consent form. To be completed by participant and faxed back to researcher (Lauren Harris) with signed consent form or before scheduled interview)

Do you have the completed survey in front of you?

SECTION III (This section will allow you to elaborate 'how' your municipality is implementing the measure in the municipality. 'Who' is involved in the process, and 'where' the implementation process is taking place, and 'when' the measure had been completed, currently being completed, or planned).

(NOTE: This section will only go over the questions identified by the participant, that the municipality completed, currently completing, or planning from the survey).

When was the measure completed? (Has it been completed already, is currently being completed, is planned to be completed in the future, OR no intent to complete).
How are the measures being implemented across the municipality (the process)?
Who was involved in this process? (Stakeholders, industry, homeowners, etc.)
Where were they completed? (Throughout the entire municipality, in a selected area, etc.)

(NOTE: These are the current probing questions, more may be added depending if participants answer the "other" question on the survey).

- Communication & Educational Programs
    - Probe: From: workshops, exhibits at public events, website information, radio, T.V., print media, demonstrations, school programs, neighborhood/community meetings, other?)
    - Probe: was it well advertised?

- Vegetation and Fuel Management
    - Probe: Have the municipality completed this:
    - 10 meters away from any building structure?
    - Within the community boundary?

- **Probe**: Have municipal parks been maintained (grass cut) to reduce minimize a wildfire impacting the municipality?

- Structure

- Infrastructure

- Emergency Preparedness Plan
    - **Probe**: Could you briefly identify the key components of the plan?
    - **Probe**: Has there been a "mock wildfire hazard" to run-though the plan to see if it would be affective (or have you had a fire and know the plan is effective)?
        - If YES, was this run through completed with:
            - First response personnel?
            - Residents?
            - Business?
            - Industry?
            - Other?

- Land-Use Planning
    - **Probe**: What are the bylaws and regulations that you have implemented?
    - **Probe**: has there been enforcement of these bylaw measures?

- Wildfire hazards assessment
    - **Probe**: Who is collecting this information? (i.e. Fire chief, summer students)
    - **Probe**: How are you using the collected information?
    - **Probe**: Is this information being provided back to residents?

- Resource Collection

- Mutual-Aid Agreements
    - **Probe**: When the written or oral agreement was first established, was it your municipality that contacted the other municipality, or did they contact you?
    - **Probe**: How often are the mutual aid agreements updated?

- Other

When was the measure completed? (Has it been completed already, is currently being completed, is planned to be completed in the future, OR no intent to complete).
How are the measures being implemented across the municipality (the process)?
Who was involved in this process? (Stakeholders, industry, homeowners, etc.)
Where were they completed? (Throughout the entire municipality, in a selected area, etc.)

(The next two sections will examine 'why' you have decided to or decided not to implement wildfire mitigation and preparedness measures).

(NOTE: the wording of some questions will differ depending on whom I am speaking with. The Fire Chief will likely know more about the wildfire measure and their implementation).

SECTION IV

- *Why* has your municipality decided to complete these wildfire measures? (**Probe**: because of potential wildfire threat, where those measure's easier to complete?)

- *(Do you know) What* factors have *helped* your municipality implement these measures? (i.e. public support, funding)

- *What* are the sources of funding that your municipality has used to implement wildfire mitigation and preparedness measures? (**Probe**: internal sources? external sources?)

- From your experience, what is the *most effective* wildfire mitigation and preparedness measure for reducing the wildfire risk in your municipality?

- Why do you feel this way?

(We have reached the half waypoint of this interview, are you still ok to proceed?)

SECTION V

Is there anything that has *hindered* your municipality's ability to implement the mitigation and preparedness measures?

(*If not sure*…. OK we will come back to that question in a moment.)

Next, I have a list of potential obstacles that could hinder the implementation of wildfire mitigation and preparedness measures. I will go through these measures one at a time and please identify to what extent they were a factor in your municipality. Can you tell me if they were a minor obstacle, major obstacle, no obstacle, or if you are unsure.

__________ Budget constraints?
Probe: Are there accessible sources of funding, that you know of (internal vs. external)?
Probe: How difficult is it to apply for funding?

__________ Lack of qualified personnel?

__________ Need for technical help with GIS or risk modeling?

__________ Inadequate knowledge level amongst local residents regarding wildfires (i.e. risk perception)?

__________ Inadequate cooperation from residents regarding the implementation of wildfire measures throughout the municipality by the municipality?

__________ Inadequate cooperation from residents to implementing wildfire mitigation and preparedness on their property?

__________ Inadequate cooperation within your municipality (from different municipal departments)?
(**Probe**: What is the working relationship between an emergency manager and the planner regarding the implementation of mitigation and preparedness measures?) example?
(**Probe**: Does wildfire implementation compete against other community services?) example?
(**Probe**: would you say that wildfire measures compliment of community services?) example?

__________ Inadequate cooperation from businesses and industry?

__________ Inadequate cooperation from other levels of government?
Probe: was this from: other municipalities, the provincial and/or federal governments? (currently and in the past)

__________ Tree protection ordinances?

__________ Inadequate public input into planning of wildfire mitigation and preparedness measures?

__________ Other (please
specify):____

SECTION VI
Is there any other information you would like to provide at this time, that I did not ask?

SECTION VII (This next section is geared to find out how you perceive wildfires and the past experience that may have affected your perceptions)

Municipal Leader Positional Questions

- What is your position title?

- How long have you been in this position?
  - If only a few months, what was your previous job?
    - In this job did you have similar employment duties?
    - Was your previous job in the same municipality?

- Have you personally had past experience with a wildfire?
  - What was your involvement?

- What was the most recent fire you have experienced (Probe: year)?
  - Was this fire in your municipality or in another municipality?

- What experiences have contributed to your perception of wildfires?
  - (**Probe**: How?)

- Have you specifically come up with any wildfire measures that are currently in implemented in your municipality?
  - What experiences have contributed to how/why you implementing specific mitigation and preparedness measures? (Probe: have you seen another community successfully implement a measure)
  - (**Probe**: How did you go about implementing the measure?)

SECTION VIII *(This section is aimed at gathering your opinion of how prepared you feel other municipal groups (other municipal leaders, residents, industry) are for a wildfire)*

Other municipal officials/leaders questions

- Do you believe that OTHER MUNICIPAL OFFICIALS in your municipality are informed about wildfire mitigation and preparedness measures?

  - Why do you feel this way?

- Do you believe that OTHER MUNICIPAL OFFICIALS in your municipality are concerned about the potential threat of a wildfire?
  - Why do you feel this way?

Residents

- Do you believe that RESIDENTS in your municipality are informed about wildfire mitigation and preparedness measures?
  - Why do you feel this way?

- Do you believe that RESIDENTS in your municipality are informed about the potential threat of a wildfire?
  - Why do you feel this way?

- Do you believe that RESIDENTS are implementing measures to protect their property against the threat of a wildfire?
  - Why do you feel this way?

- Have you provided RESIDENTS with any information regarding wildfires in general or what they can do to protect them and their properties?
  YES PARTIALLY NO DON'T KNOW
  - Is there a particular reason why you have OR have not?
  - What kinds of information have you provided?

- Have you collected information/data from RESIDENTS regarding what they know about wildfires?

  - Have you collected this information and provided feedback to the RESIDENTS regarding your findings?
    YES NO DON'T KNOW

Industry

- Could you please tell me what industries and businesses are found in your municipality? (Probe: forestry, oil and gas, camp site, accommodation providers) *(NOTE: if this was not answered at the beginning of the interview)*

- Do you believe that INDUSTRIES AND BUSINESSES are implementing measures to protect their company against the threat of a wildfire?
  YES PARTIALLY NO DON'T KNOW

  - Why do you feel this way?

- Are you working with INDUSTRIES AND BUSINESSES in your municipality to protect their companies from wildfires?
  - If YES, was the initial contact from the:
  - Municipality?
  - Industry/Business?
  - Not sure?

- Do you believe that INDUSTRIES AND BUSINESSES are informed about wildfire mitigation and preparedness measures?

  - Why do you feel this way?

- Do you believe that INDUSTRIES AND BUSINESSES are concerned about the potential threat of a wildfire?

  - Why do you feel this way?

- Have you provided INDUSTRIES AND BUSINESSES with any information about wildfires in general or what they can do to protect themselves and their company property?
  YES PARTIALLY NO DON'T KNOW

  - Is there a particular reason why you have OR have not?
  - Which industries/businesses have you provided information to?
  - How are they being informed?

  - Why have you chosen these methods?

- Have you collected information/data from INDUSTRIES AND BUSINESSES about what they know about wildfires?
  YES PARTIALLY NO DON'T KNOW
  - Have you collected this information and provided feedback to the INDUSTRIES regarding your findings?
    YES NO DON'T KNOW

(This completes the interview questions...)

SECTION VIII

Is there any other information you would like to provide, that I may not have asked which you feel is important for this study?

Would you like a copy of the results, once my study is completed? (fax or email)

If at any time you wish to get in contact with me, please feel free to do so.
My information is on the letter of research intent that I send a few weeks ago.
Lauren Harris Phone: (780) 492-5879 Fax: (780) 492-2030
Thank you very much for your time.

Appendix E- Phase 2: Interview Guides with Municipal Officials, Provincial Government, and the Public

Code: **Date:** **Time Start:** **Time Finish:**

Municipal Department/Provincial Government Topics
What is the current wildfire threat?
What is the potential wildfire threat?
When did that last wildfire urban interface fire occur?

Municipal implementation of wildfire measures…

- Is the municipality implementing wildfire management measures?
- What has influenced the effective implementation of wildfire management measures (both positive and negative)?
- Why is implementing wildfire management measures important?
- Is your department involvement in wildfire management?
- Does the municipality have a specific wildfire committee (what is there role)?

What measures is your department completing, what measures are other department completing?

- (Communication, Vegetation Management, Structural Measures, Infrastructure Measures, Emergency Preparedness Plan, Land-Use Planning, Wildfire Hazard Assessments)
- Other (Resource Collection, Mutual-Aid Agreement, Other)

What measure have residents, industry, municipality been most responsive to? (why)

Funding- where is it coming from?

What are factors that have helped implement wildfire management measures?

What are factors that have hindered implement wildfire management measures?

Tell me about the working relationship between yourself and

- Fire chief
- Senior Planner
- Mayor

Personal Attributes and Perceptions (Time in position, previous position, past experience with a wildfire, experiences contributing to you perception of wildfires)?
Additional Information

Code: Date: Time Start: Time Finish:

Industry/ Business/Residents/Environmental Group Topics

Personal Attributes and Perceptions (Length of time lived in the municipality, past experience with a wildfire, experiences contributing to you perception of wildfires)?

What is the relationship between yourself/company and the municipality?

Who is responsible in your municipality for preparing municipality for a wildfire? (why)

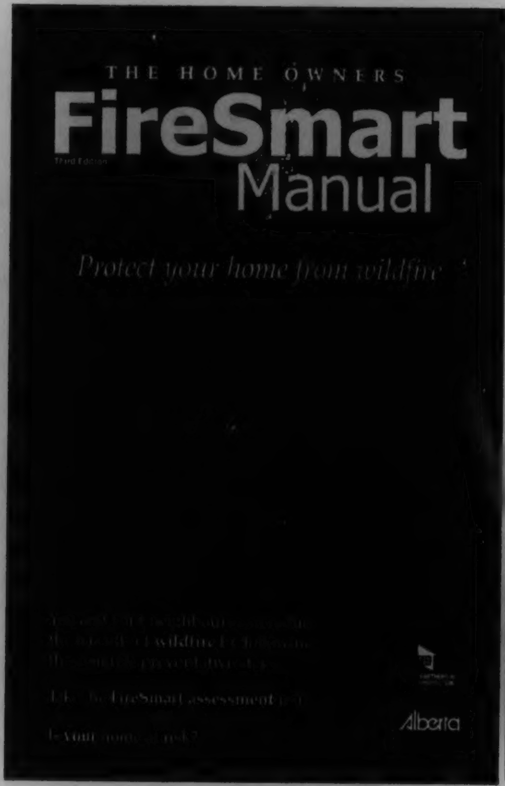
Are you aware of how the municipality is implementing wildfire management measures?

- What have been their strengths and weaknesses?

Are you involvement with the municipality during the implementation of wildfire management measures?

Additional Information

Appendix F- FireSmart Homeowners Manual



THE HOME OWNERS

FireSmart

Third Edition

Manual

Protect your home from wildfire

[illegible] wildfire [illegible]

[illegible] FireSmart assessment [illegible]

[illegible] your home at risk?

Alberta

The Rural Reality

Forest and prairie wildfires are capable of spreading at an astonishing rate. Crowning wildfires often spread at rates of 7 kilometres per hour, and can potentially send embers as far as 2 kilometres ahead of the fire. Wind blown prairie fires can travel at speeds in excess of 10 kilometres per hour.

In Alberta, 40 per cent of wildfires are caused by human activity. The remaining 60 per cent are sparked naturally by lightning.

Over the last 10 years, an average of 1,000 wildfires a year have burned 190,000 hectares of forest annually in Alberta. Wildfires have forced the evacuation of thousands of people from their communities, and have even destroyed some homes.

If you live in or near a forested area, sooner or later you may have to contend with the spread of a wildfire. The best way to protect yourself against loss, damage or injury is to practice FireSmart principles on your property.

By following the FireSmart Home Owner's Manual, you can help reduce that risk.

Get Ready

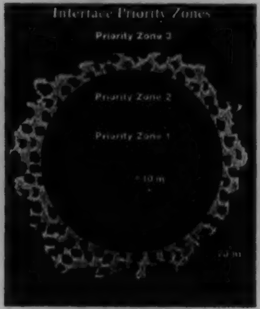
Properly preparing your home and community doesn't completely guarantee you won't incur fire damage, but it does reduce the risk. Make sure you have adequate insurance on your home and property.

Some of the measures in this manual cost very little and help reduce your vulnerability to wildfire; others require planning and a long-term commitment.

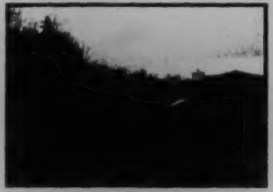
Let's look at three areas where you can apply FireSmart principles to protect or reduce the damage to your property should a wildfire strike.

Site Preparation

Any kind of vegetation is combustible.
Mature trees, shrubs, grass and even your woodpile can easily ignite and increase the chance of wildfire damaging your home and property. Managing the space around your home and buildings is of utmost importance.



Do you have a cleared zone around your house and buildings?
The 10 metre space immediately surrounding your home is Priority Zone 1. It's the most critical area to introduce FireSmart principles. A fuel-free space will give firefighters a chance to save your home from an advancing wildfire. A home without a fuel-free space can make firefighting difficult, if not impossible.



Lawn or non-combustible material
- within 30 metres of building (0 pts).

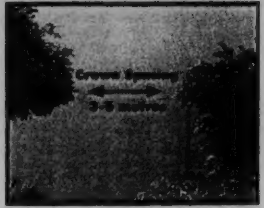
What to do?
Remove flammable trees and shrubs, such as pine, spruce and juniper. Other species such as aspen, poplar and birch have lower flammability rates. Also remove deadfall or woodpiles from this area. Keep your grass mowed and watered.

How FireSmart is your "Second Priority" zone?
The area extending from 10 to 30 metres away from your home is Priority Zone 2. In this zone, you need to reduce fuels by thinning and pruning trees so that intense wildfires don't have as much fuel to burn.

What to do?
Remove any trees and debris that would support the rapid spread of a wildfire. Make sure to thin or space trees so that the crowns (tops) of individual trees are at least 3-6 metres apart.

Remove tree branches up to 2 metres from the ground, thick shrubbery, and deadfall to reduce the chance that a wildfire will climb up into the forest canopy. Once a wildfire is crowning, it's very difficult to stop.

Because fires spread more easily uphill and downwind it's important to extend Priority Zone 2 further on downhill slopes and on windward exposures.



Can you extend your FireSmart maintenance plan to the "Third Priority" zone?
Priority Zone 3 begins 30 metres from your home and extends to a distance of 100 metres and beyond. In this zone the idea is not to remove all combustible fuels from the forest, but to thin the area so fires will be low intensity and more easily extinguished.

What to do?
Thin or reduce the shrubs and trees that make up the understory. Try to keep fire resistant trees such as aspen, poplar and birch, while spacing more flammable trees so that their crowns are at least 3-6 metres apart.

These are...
simple economical steps anyone can take to create a FireSmart home, community or business site. To ensure years of protection, make sure you maintain your FireSmart Priority Zones.

Emergency Phone Numbers

Find and copy down the emergency numbers for your area and keep them in a visible area close to your telephone.

Fire Department: ____________________

Police: ____________________

Alberta Sustainable Resource Development
Forest Protection Division Office: ____________________

To report a forest fire call 310-FIRE

Property Identification:
Section _____ Township_____ Range _____ West of the _____ Meridian
Or
Lot _____ Blk _____ Plan_____
Or
Street Address ____

For more information about protecting your home and community from wildfire, order a copy of "FireSmart, Protecting Your Community from Wildfire". Copies are available from Partners in Protection by calling (780) 435-7283 or visiting **http://www.partnersinprotection.ab.ca/downloads/index.shtml** or from your local Alberta Sustainable Resource Development, Forest Protection office.

For more information on wildfire in Alberta:
www3.gov.ab.ca/srd/wildfires

For fire ban information in Alberta:
www.albertafirebans.ca

For more information on the Alberta Forest Protection Division program contact the Wildfire Management Area nearest you:

Clearwater
Tel. (403) 845-8272
Fax (403) 845-7999

Foothills
Tel. (780) 723-8269
Fax (780) 712-4483

Lac La Biche
Tel. (780) 623-5388
Fax (780) 623-2570

Lesser Slave
Tel. (780) 849-7400
Fax (780) 849-3299

Peace
Tel. (780) 624-6190
Fax (780) 624-7127

Smoky
Tel. (780) 538-5560
Fax (780) 538-5522

Southern Rockies
Tel. (403) 297-8800
Fax (403) 297-8803

Upper Hay
Tel. (780) 926-3761
Fax (780) 926-5446

Waterways
Tel. (780) 743-7125
Fax (780) 743-2559

Woodlands
Tel. (780) 778-7237
Fax (780) 778-4659

Alberta Provincial Forest Fire Centre
Information Centre
Main Floor, 9920 - 108 Street
Edmonton, Alberta, Canada T5K 2M4
1-780-944-0313
srd.infocent@gov.ab.ca

To order this manual, contact:

Information Centre
Main Floor, 9920 - 108 Street
Edmonton, Alberta, Canada T5K 2M4
1-780-944-0313
srd.infocent@gov.ab.ca

Building Construction

The second set of FireSmart guidelines deals with building materials and design standards. While it may not be practical or economical to apply all of them to an existing structure, many FireSmart modifications are easily accomplished. Others can be included in long-term maintenance or renovation plans, and incorporated in new structures as they are designed and constructed.

Is your roof FireSmart?
The most fire resistant roofing materials are metal, clay tile, and asphalt shingles. Untreated wooden shakes and shingles provide no resistance. They are ideal fuels for an advancing wildfire.

Ensure your roof is free of combustible needles and leaves and there are no overhanging trees or branches that can provide fuel for airborne sparks and embers.

PHOTO KELVIN HIRSCH

Metal, tile, asphalt, ULC-rated treated shakes or non-combustible material (0 pts) - *the most fire resistant and remain effective under severe fire exposure.*

PHOTO KELVIN HIRSCH

Unrated wood shakes (30 pts) - *provide no fire protection.*

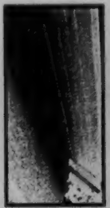
PHOTO KELVIN HIRSCH

Non-combustible siding (0 pts)
Materials such as stucco, metal siding, brick cement shingles, concrete block, poured concrete, and rock offer superior fire resistance.

Are your exterior walls FireSmart?
Materials such as stucco, metal, brick and concrete offer superior resistance to wildfire. Logs and heavy timber are less effective, and wood and vinyl siding offer very little protection.

Is the exterior of your home vulnerable to firebrand ignition?
If you are designing your home, eliminate areas where firebrands (airborne sparks and embers) could accumulate and ignite siding, windowsills or trim. Exterior siding should be fire resistant and extend from ground level to the roofline.

Eaves and vents are ready-made openings that can allow heat and embers to enter a building and ignite. Ensure eaves are closed in and screen all vents and soffits. Keep areas under decks and porches clear of debris and sheath the undersides with fire resistant material.


Closed eaves, vents screened with 3-millimetre mesh and accessible (0 pts)

Closed eaves, vents not screened with 3-millimetre mesh (1 pt)

Open eaves, vents not screened (6 pts)

PHOTOS: DON MORTIMER

Are your doors and windows FireSmart?
Be sure to remove flammable forest fuels within 10 metres of glazed window and door openings. Tempered, thermal, or smaller double-pane windows will provide far greater protection than single pane glass.

PHOTO: PELLA WINDOWS

Tempered (0 pts) - *optimum protection is provided by tempered glass.*

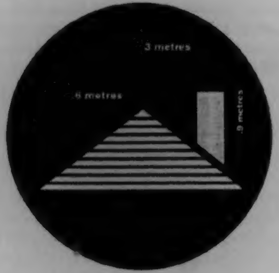
PHOTO KELVIN HIRSCH

Single pane (2 or 4 pts) - *virtually no protection is provided by single pane glass.*

PHOTO: PELLA WINDOWS

Double pane (1 or 2 pts) - *moderate protection is provided by double or thermal pane windows.*

Don't Be the Cause of a Wildfire



Wildfires often start as small accidental ignitions. By using FireSmart standards around your property you can help prevent an accidental wildfire from starting.

FireSmart your chimney
Chimneys should be constructed to meet Alberta building code requirements and have approved spark arrestors installed.

Burn barrels and fire pits
Burn barrels and fire pits should be located away from buildings and 3 metres away from other combustible material. Always ensure your burn barrel has proper ventilation and is covered with a screen. Never leave your burning barrel or fire pit unattended while it is in use. For a safer method of disposal bring your debris to a local landfill site.

6 to 16 mm wire mesh

PHOTO BRIAN MOTTUS

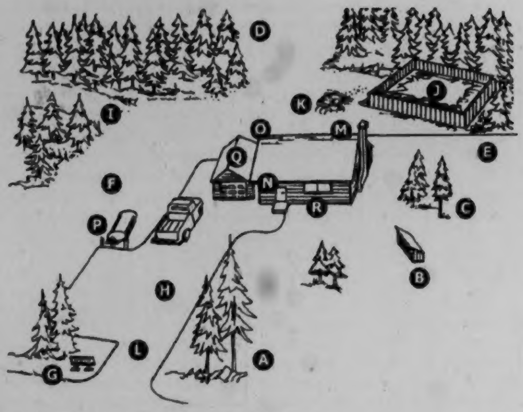
Contact your utility company to clear away vegetation around overhead electrical installations.

Power lines and propane tanks
Vegetation should be cleared away from power lines, propane tanks and other fuel supplies.

Emergency facilities
Ensure your property has adequate emergency vehicle access and an on-site emergency water supply, such as a pond, tank, creek or lake.

On-site fire tools
Every home should have shovels, rakes, axes, garden hoses, sprinklers and ladders to assist in suppressing wildfires and protecting homes.

A Well Thought Out FireSmart Protection Plan



A Prune tree branches to a minimum height of 2 metres
B Store firewood a minimum of 10 metres from any structures (avoid down slope location)
C Remove all combustible trees, long grass, shrubs, logs, branches, twigs and needles within 10 metres of a structure
D Thin trees (with 3-6 metres between crowns) for at least 30 metres from any structure
E Contact your utility company if trees or branches are not clear of power lines
F Keep grass within 10 metres of buildings mowed and watered
G Have your address, municipal fire number or lot number clearly visible for quick identification by fire services
H Make sure your driveway is wide enough to accommodate emergency vehicles so they have enough space to turn around
I Provide an alternate emergency access route to and from your property
J Have a nearby pond or tank with an emergency water supply
K FireSmart your fire pit or burning barrel
L Clear your driveway of trees to a distance of at least 3 metres on either side
M Make sure your chimney is to code and has spark arrestor screens installed
N Close in your eaves, vents, and soffits
O Sheath undersides of balconies, decks and crawlspaces with flame resistant materials
P Locate propane tanks at least 10 metres from any building and clear vegetation at least 3 metres around propane tanks
Q Use only Class A, B, or C rated fire resistant roofing and fire resistant exterior siding
R Install solid shutters or metal firescreens to provide increased fire protection for windows and doors

Do Your Own Home and Site Hazard Assessment

Assign yourself the indicated number of points for each assessment area. The fewer points you get, the more prepared your property is to successfully survive a wildfire. If a question does not apply to your home, score 0.

PHOTO CDF

Home & Site Hazard Assessment

Important Factors	Characteristics of Material	Point Rating	Your Score
What kind of roofing material do you have?	Metal, clay tile, asphalt shingle, or ULC rated shakes	0	
	Unrated wood shakes	30	
How clean is your roof?	No needles, leaves or other combustible materials	0	
	A scattering of needles and leaves	2	
	Clogged gutters and extensive leaves	3	
What is the exterior of your home built of?	Non-combustible material stucco, metal siding or brick	0	
	Logs or heavy timbers	1	
	Wood, vinyl siding or wood shakes	6	
Are your eaves and vents closed-up and screened?	Closed eaves and vents with 3 mm of wire mesh	0	
	Closed eaves and vents with no mesh	1	
	Open eaves and vents	6	
Have you screened-in the underside of your balcony, deck or porch?	Decks, balconies and porches are screened or sheathed with fire resistant materials	0	
	Decks, balconies and porches are screened or sheathed with combustible materials	2	
	Decks, balconies and porches are not screened or sheathed	6	
How fire resistant are your windows and doors?	Tempered glass in all doors/windows	0	
	Double pane glass: • Small/Medium • Large	 1 2	
	Single pane glass: • Small/Medium • Large	 2 4	
Where is your woodpile or other combustibles located?	More than 10 metres away from any building	0	
	Less than 10 metres away from any building	6	
Is your home set back from the edge of a slope?	Building is located on the bottom or lower portion of a hill	0	
	Building is located on the mid to upper portion or crest of a hill	6	

Low <21 points Moderate 21-29 points High 30-35 points Extreme >35 points

Home & Site Hazard Assessment

Important Factors	Potential Hazards	Point Rating	Your Score
What type of forest surrounds your home, and how far away is it?	Deciduous trees (poplar, birch) within 10 metres of buildings	0	
	Deciduous trees 10-30 metres from buildings	0	
	Mixed wood (poplar/birch & spruce/pine) within 10 metres of buildings	30	
	Mixed wood 10 - 30 metres from buildings	10	
	Conifers (spruce, pine or fir) within 10 metres of buildings • Separated • Continuous	30 30	
	Conifers (spruce, pine or fir) within 10 - 30 metres of buildings • Separated • Continuous	10 30	
What kind of surface vegetation grows in the zones around your buildings?	Well watered lawn or non-combustible landscaping material	0	
	Uncut wild grass or shrubs • Within 10 metres of buildings • Within 10 - 30 metres of buildings	30 5	
	Dead and downed woody material within 10 metres of building • Scattered • Abundant	30 30	
	Dead and downed woody material within 10-30 metres of building • Scattered • Abundant	5 30	
Are there abundant underbrush and ladder fuels in the surrounding forest?	None within 10 -30 metres	0	
	Scattered within 10 - 30 metres of buildings	5	
	Abundant within 10 - 30 metres of buildings	10	
The Wildfire Hazard Level for your home is:		Total Score	

Low <21 points   Moderate 21-29 points   High 30-35 points   Extreme >35 points

Other FireSmart Considerations

Important Factors	Yes	No
Do you have adequate insurance on your home and property?		
Do you have the necessary fire suppression equipment (shovels, rakes, buckets, hoses, etc.) easily accessible?		
Are your burn barrels screened and at least 10 metres from combustibles and buildings?		
Are overhead power lines clear of vegetation and at least a tree's length away from nearby forest?		
Are propane tanks clear of vegetation and at least 10 metres away from your home and other buildings?		
Are emergency fire services within a 10 minute drive from your home?		
Is you chimney clean? Does it have proper clearances, screens and spark arrestors?		
Do you have adequate access to your property for emergency response vehicles?		
Is the area within 10 metres of your home and other buildings free of flammable trees, other vegetation, and combustible materials?		
Do you have an adequate and accessible on-site water supply in case of fire?		
Does your family have an emergency fire and evacuation plan?		

TO REPORT A WILDFIRE CALL **310-**

Alberta